POST GRADUATE SCHOOL CALENDAR

1993-94

INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI

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POST GRADUATE SCHOOL
CALENDAR
1993-94

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INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI

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Preface

This edition of the Post-Graduate School Calendar contains the rules, regulations and guidelines governing post-graduate education and training programmes at the Indian Agricultural Research Institute, New Delhi, incorporating the additions and amendments approved by the Academic Council since last issue in 1984-85 and shall be in force with amendments and modifications made by the Academic Council form time to time.

The contribution made by the Special Committee constituted under the chairmanship of Dr. Anupam Verma, Head of the Division of Mycology & Plant Pathology with Dr. M.S. Khera, Ex-Head, Soil Science & Agril. Chemistry, Dr. Y.N. Rao, Head, Agricultural Physics; Dr. J.S. Panwar, Professor & Head, Agricultural Engineering, Dr. R.P. Sharma, Head, Bio Technology Centre. Dr. Mruthyunjaya, Professor, Agricultural Economics and Shri A.K. Chaturvedi, Registrar (Academic) as its members in updating the Calendar is gratefully acknowledged. Sincere appreciation is due to the Bioinformatics Centre and Shri Nathi Singh, Asstt. Admn. officer, and Shri Chetan Swaroop Issar, Assistant, Post Graduate School in the preparation of this Calendar.

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1 The Institute

1.1 Functions

1.1.1 The Indian Agricultural Research Institute (IARI) is India's premier institution in the field of agricultural research, higher education in agriculture (post-graduate programme) and extension education. Since 1958 it enjoys the status of a deemed university under the University Grants Commission Act of 1956 and is authorised to award post-graduate.degrees of Master of Science and Doctor of Philosophy in agricultural sciences and its related basic disciplines.

1.1.2 The primary functions of the Institute are (i) basic and applied research in the various branches of agricultural sciences, (ii) teaching at the post-graduate level and organisation of special short-term training programmes in several aspects of agricultural sciences, both at the national and international levels and (iii) extension advisory work for improving farm productivity and socio-economic conditions of the farming community.

1.2 Origin, growth and development

1.2.1 The Institute was originally established by the Government of India in 1905 at a village called Pusa in North Bihar. Its establishment was greatly helped by an American philanthropist Mr. Henry Phipps, after whom the main building in Pusa was named. After the devastating earthquake of Bihar in 1934, the Institute was shifted to its present site in New Delhi in 1936. This is why it is popularly known as the "Pusa Institute". The Institute has inherited a great tradition of agricultural research and training at the post-graduate level. Since its early days of Pusa, the Institute has done pioneering work in the various fields of agricultural sciences, apart from the organisation of the prestigious training programme leading to the Associateship of IARI. Special mention may be made in this connection of outstanding wheat varieties bred by Albert Howard and his wife Gabrielle, which became famous as the "Pusa Wheats" both in India and abroad. The Howards and later F.J.F. Shaw were responsible for the evolution of improved varieties of many other crops. The contributions of E.J. Butler in the field of fungi and fungal diseases of crops, and of H.M. Lefroy and T.B. Fletcher in Entomology were most outstanding. So were the contributions of J.W. Leather in Agricultural Chemistry. The "Co" varieties of sugarcane, which are now famous the world over and which greatly helped in revolutionising the sugar industry in India, were produced by C.A. Barber and T.S. Venkataraman at the Sugarcane Breeding Station (now Sugarcane Breeding Institute) at Coimbatore, which until 1950 was a part of this Institute.

1.2.2 In the post-independence years, the Institute has expanded very greatly in its activities, research facilities and scientific personnel. When the Institute came to Delhi in 1936, it had five sections. Today there are twenty two Divisions and interdisciplinary Research Centres; an Advanced Centre for Plant Virology, a National Facility for Blue Green Algae and a Bioinformatic Centre for doing research work under different soil and climatic conditions prevailing in the country. The Institute has nine Regional Stations located at Indore, Kalimpong, Karnal, Katrain, Pune, Pusa and Shimla (two regional stations) and Willingdon. The principal research themes of various Divisions are as follows :

Division of Agricultural Chemicals : Research on the design and development of pesticides and allied chemicals utilising botanical, synthetic or industrial waste resources; pesticide formulation; research and development; evaluation of protection schedules on agricultural crops and post-harvest products; pesticide transformations including degradation, persistence and interaction in eco-system and development and standardisation of macro- or micro analytical techniques for the analysis of agro-chemicals.

Division of Agricultural Economics : Research in farm management and production economics; agricultural marketing and prices; agricultural finance and cooperation, agricultural econometrics, agricultural development and policy.

Division of Agricultural Engineering : Research on design and development of efficient agricultural tools and implements, equipment and machinery including design of drying equipment, processing equipment, storage and other structures, rural water supply, utilization of renewable energy sources in agriculture.

Division of Agricultural Extension : Fundamental and applied research in the areas related to promoting agricultural productivity; people's self action for development; development needs of rural women and their participation in agricultural development.

Division of Agricultural Physics : Basic and applied research in different fields of agricultural physics, namely, soil physics, biophysics, and environmental physics including remote sensing and agricultural meteorology.

Division of Agronomy : Development of improved techniques of crop production; weed control; soil and water management; cropping systems for irrigated and rainfed conditions.

Division of Biochemistry : Genetic Engineering of *Lathyrus sativus* to make it toxin-free, Hup + gene insertion in Cicer rhizobia, mechanism of action of plant hormones, effect of dietary protein quality on animal metabolism and cytochrome oxidase insensitivity to CO in plants and biochemical basis of disease resistance.

Division of Entomology : Research in fundamental and applied aspects of entomology with a view to devising effective methods of pest management; identification of insect pests and parasites; research in economic zoology including ornithology and acarology.

Division of Environmental Sciences.

Division of Floriculture and Landscaping : Improvement and standardization of the package of practices for ornamental plants.

Division of Fruits & Horticultural Technology : Improvement of fruit plants and development of improved technology for preservation of horticultural produce.

Division of Genetics : Development of improved varieties of crop plants showing wide adaptability and possessing disease resistance and other quality characters, research in fundamental genetics and cytogenetics.

Division of Microbiology : Study of the physiology and biology of various soil micro-organisms; to evaluate the nitrogen fixing efficiency of different bacterial and algal strains; to isolate and maintain cultures of micro-organisms useful to agriculture and to develop more efficient strains; to devise techniques of soil and seed inoculation with these micro-organisms; to study the biochemical aspects of various microbiological transformations; and to carry out basic studies of beneficial micro-organisms to generate information on plant-root-soil micro-organisms associations.

Division of Mycology and Plant Pathology : The main objective of the division is to generate data pertaining to the identification/detection of plant pathogens (fungi, bacteria, mycoplasma, viruses, viroids) and their management. The programme includes diseases of economically important agricultural/horticultural crops and emphasises the areas of molecular characterisation of plant pathogens, distribution of races/virulences/genotypes, resistant sources, epidemiology, disease forecasting, assessment of losses, apoplastic/symplastic movement of chemicals, interaction amongst chemicals, resistant mutants, development of detection kits for plant pathogens with the use of ELISA, dot blot, etc. clone pathogenic species specific genes, transfer useful genes to host plants, tissue culture, physiology of host-pathogen interaction and taxonomy of plant pathogens.

Division of Nematology : Taxonomic studies on plant parasitic nematodes with view to identify and map their distribution in association with crops (cereals, vegetables, pulses and oilseeds) in different agro-climate zones of India; biochemical and physiological basis of plant nematode relationship with special reference to mechanism of host resistance; Assessment of losses in important crops due to plant parasitic nematodes and planning of their management with a view to minimise the use of chemicals.

Division of Plant Physiology : Photosynthesis including carbon and nitrogen metabolism, stress physiology (water, temperature and radiation), mineral nutrition, physiology of reproduction, tissue culture, plant growth regulators and production physiology of crops.

Division of Seed Science and Technology : To conduct research on all aspects of seed technology; training of seed technologists to ensure the availability of high quality seeds of the high yielding improved varieties; to function as the Central Laboratory for fixing seed standards.

Division of Soil Science and Agricultural Chemistry : Fundamental and applied research on the physical, chemical, mineralogical and biological properties of soils, fertilizers and manures and their interaction with soil and plant for improvement and maintenance of soil fertility for sustained optimum agricultural production. Other important lines of investigations relate to the utilization of organic residues (wastes) as manure and production of biogas as fuel. Soil test crop response correlation study and advice to the farmers on fertilizer recommendations based on soil test.

Division of Vegetables Crops : Development of improved varieties and F1 hybrids of vegetables.

Biotechnology Centre : Research on genome organisation and gene expression; molecular genetics of legume-Rhizobium symbiosis; biological nitrogen fixation; molecular biology of plasmids and other extra chromosomal genomes; plant cell and tissue culture.

Nuclear Research Laboratory : Application of nuclear and allied modern techniques in agricultural research with particular reference to application of Nuclear Magnetic Resonance (NMR) for development of rapid and nondestructive methods for characterisation of plant and soil materials; use of isotopes in efficient use of fertilizers and micronutrients and study of biochemical and physiological processes in plants; study of clay mineralogy and mineral weathering of soils using X-ray diffraction; hydrology; nuclear techniques in control of plant diseases and insect pests; preservation of fruits, vegetables and grains by gamma radiation.

Water Technology Centre : Integrated research on all aspects of water use and management in agriculture.

1.2.3 The Institute also serves as the headquarters of a number of all India Coordinated Crop Improvement Projects. The All-India Soil and Land Use Survey and the Division of Plant Introduction which were part of the Institute till recently have now been set up as independent institutions under the Indian Council of Agricultural Research.

1.2.4 For conducting field experiments, the Institute has at its headquarters an extensive farm area (including a horticultural nursery and orchard) covering about 296 hectares of which 160 hectares are irrigated and the remainder used for research under *barani* or dryfarming conditions. The Farm Operations and Service Unit (FOSU) is responsible for the upkeep of the farm and the maintenance of the farm equipment and machinery.

1.3 Research facilities

The research facilities available at the Institute are amongst the best that can be had in the country. The various Divisions of the Institute are manned by a large body of highly trained and experienced scientific staff. The laboratories are equipped on modern lines for conducting research of a high order. The various Divisions of the Institute have active research programmes of their own and, in addition, considerable cooperative research is done in collaboration with the other research Institutions, the State Departments of Agriculture in India and also with foreign research promoting bodies like the FAO, UNDP, the Ford Foundation, etc. The various Divisions also maintain close contact and liaison with the user institutions and render advisory function to such institutions in their respective fields.

1.4 Post Graduate education

1.4.1 Since its early years, the Institute had flourished as centre for imparting post-graduate training to officers of the State Departments of Agriculture as also other candidates, so as to equip them for manning important positions in the fields of research, teaching, and extension. In 1923, the training programme was placed on an organised footing and two-year courses of specialised post-graduate training leading to the Associateship of the Institute (Assoc. IARI) were organised in different major fields of agricultural science. This programme was reviewed comprehensively in 1945 and a regular programme of instruction and examination, including lectures, practical work and field investigation was introduced. These diploma courses were replaced by postgraduate courses leading to the M.Sc. and Ph.D. degrees of the Institute in 1958 when it was given the status of a "deemed University" under the University Grants Commission Act of 1956. With regard to educational standards and quality, the Institute ranks among the best institutions of post graduate education in the world. A unique feature of the system of instruction at the Institute, which is largely modelled on the course-credit system obtaining in many universities of the U.S.A., is that research, teaching and extension are fully integrated and the programme of instruction is broad based so as to give the student a mastery not only in his major field of specialisation but also in the supporting minor fields. Currently, instruction leading to the post graduate degrees of the Institute is organised in 20 disciplines viz. Agricultural Chemicals, Agricultural Economics, Agricultural Engineering, Agricultural Extension, Agricultural Physics, Agricultural Statistics, Agronomy, Biochemistry, Computer Application, Entomology, Genetics, Horticulture, Microbiology, Molecular Biology and Biotechnology, Mycology and Plant Pathology, Nematology, Plant Physiology, Soil Science and Agricultural Chemistry, Environmental Sciences and Seed Science and Technology. The educational programmes in the field of Agricultural Statistics and Computer Application are organised in cooperation with the Indian Agricultural Statistics Research Institute (IASRI) of the Indian Council of Agricultural Research. The Institute played a notable role in the development and upgradation of the faculty in the newly set up Agricultural Universities when it collaborated with the USAID. Under this programme selected members of faculty from Agricultural Universities did their course work in universities of the U.S.A. and completed their research work and degree requirements at the IARI. A fruitful phase of bilateral cooperation was also completed in collaboration with the International Rice Research Institute, Philippines whereby both Indian and foreign students completed their course work at IARI and the research work at IRRI for the award of the IARI degree.

1.4.2 Upto the 32nd Convocation held on 11.2.94, the Ph.D. degree had been awarded to 2631 students and the M.Sc. degree to 2100 students. The postgraduate students (presently numbering about 600 including a number of female students) come from all over India and from several foreign countries such as Afghanistan, United Arab Republic of Egypt, Bangladesh, Cyprus, Guyana, Iran, Iraq, Jordan, People's Democratic Republic of Yemen, Malaysia, Malawi, Mauritius, Nepal, Nigeria, Sierra Leone, Philippines, Singapore, Sri Lanka, Thailand, Trinidad, USA etc. There are seven large hostels, complete with spacious dining and common rooms, separately for male and female students and for married students, a gymnasium and a playfield. Alumni of the Institute are now occupying positions of responsibility in the various agricultural universities in the country and in the several other agricultural colleges and institutes. Many of them are also occupying responsible positions abroad.

1.5 Extension activities

1.5.1 Beside post-graduate teaching and research, the Institute carries extension activities including agricultural development, advisory service and training. This effort, in which all the Divisions of the Institute participate is coordinated by the Division of Agricultural Extension, and the Production Unit. In addition, the Division conducts researches both basic and applied in various aspects of extension education, such as extension methods and techniques, agriculture, agricultural communication, adoption and diffusion of innovations, etc. In order to disseminate the research findings of the Institute and get direct feed back, the Division carried out extension programmes like (i) Intensive cultivation scheme in 1950, covering whole of Kanjwala block of Delhi territory by 1959, (ii) Seed village in 1964, (iii) Minikit demonstrations, (iv) Operational Research Project-I (ORP-I) in 1975, (v) ORP-II in 1978, (vi) Lab to Land Programme in 1979, and ORP-III in 1984. A Krishi Vigyan Kendra was established at village Shikohpur of Gurgaon district of Haryana in 1984.

1.5.2 The Division of Agricultural Extension with the help of scientists in the Production Unit prepares, publishes and distributes a large number of extension literatures based on crop production-oriented information, prepared out of results of IARI researches and recommendations.

1.5.3 The Institute's annual Krishi Vigyan Melas have attained all-India status and every year about 10,000 to 15,000 farmers, extension workers, students and teachers visit these Melas. The Institute through its Extension Division and Scientific Information Unit has very close collaboration with the All-India Radio for its Krishi Jagat (Radio) and Krishi Darshan (Television) programme.

1.5.4 The Institute opened a new frontier to address itself to different agricultural problems of the areas beyond the Union Territory of Delhi. Consequently its extension activities were extended to (i) the water deficit semi arid sandy belt of Gurgaon district of Haryana in 1984 (ii) Sultanpur and Raibareli districts of U.P. in 1985 suffering from low agricultural productivity, (iii) Lakhimpur Kheri district of U.P. in 1985 for tribal development, (iv) Gorakhpur and Deoria districts of U.P. in 1987 suffering from poor water management and low farm productivity, (v) Fatehpur and Banda districts of U.P. in 1988, a rainfed area with poor soil and water management, (vi) Munger district of Bihar, a flood prone are in 1986 (vii) Tribal and rainfed area of Raigarh district of M.P. in 1988 and (viii) low productive area of Varanasi district of U.P. in 1989. The Institute, through its extension activities in these areas brought about spectacular increase in farm productivity and improved socio-economic conditions of the farming community.

1.5.5 The Division of Agricultural Extension started an extension programme with participatory approach in village Sikarpur of Delhi Territory in 1988. Encouraged with the success achieved in the programme the Institute has decided to open an Extension Centre in the village with permanent structure and staff unit.

1.6 Library

1.6.1 IARI Library is the *de facto* National Agricultural Library of India having the largest agro-biological literature collection to the mark of 6.0 lakhs publications in 40 languages from 90 countries of the world. It has 10,500 serial files, procures 5,000 current serial titles and has the largest periodical exchange programme for 1,000 titles from 500 parties of the world.

1.6.2 The library has collected and built Indian Agricultural Data base on card form which consists of 1,40,000 references on agriculture, particularly on Plant Sciences. Under its documentation and current awareness services the library brings out 1) Bibliography of Indian Agriculture, 2) Futuristic Agriculture, 3) Developmental News in Agriculture, 4) Monthly List of Additions. The library has also compiled and published a (1) Bibliography of IARI Theses-1938-69, (2) Bibliography of IARI publications 1905-63, (3) Catalogue of serials in IARI Library 1905-67, and its Supplement from 1967 to 1987, and (4) A guide to information sources in IARI Library (1985) containing secondary source material.

1.6.3 The IARI Library is providing information services to 2,000 staff and students of IARI and 8,000 more who visit from different parts of the country for literature search and consultation. The library is also the depository of FAO, World Bank, CGIAR/ISNAR, AVRDC, IDRC, etc. The library has three faculty members who are teaching one credit compulsory course on 'Agricultural Information System' for PG students of IARI.

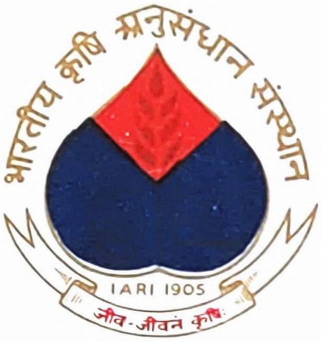
1.6.4 The library has taken the initiatives of computerising its literature resources from January, 1991 and has computerised secondary source material.

1.7 Location and campus

1.7.1 The Institute is located about 5 and 8 km respectively west of the New Delhi and the Old Delhi railway stations on a self-contained 473 hectares campus of its own, at a latitude of 28.04° N and longitude 77.12° E, and at an elevation of 228.6 meters (750 ft.) above mean sea level. The climate of Delhi is semi-arid, sub-tropical with hot summers and cool winters. The mean monthly maximum and minimum temperatures during the year ranges from 21.3°C to 40.5°C and 7.3°C to 28.7°C respectively. The annual normal rainfall is 708.6 mm of which on an average 597 mm (84%) is received from June to September and 85 mm (12%) during the winter months, i.e. November to March.

1.7.2 In addition to the library, laboratories and the offices, residential accommodation is also provided on the campus. The amenities on the campus include a medical dispensary, a shopping complex, two government higher secondary schools (one for boys and another for girls), a nursery school run by the Nehru Experimental Centre, provisions store, a Post Office and a nationalised bank. The Indian Agricultural Statistics Research Institute and National Bureau of Plant Genetic Resources of the Indian Council of Agricultural Research, the National Physical Laboratory under the Council of Scientific and Industrial Research (CSIR), the Institute of Hotel Management, Catering and Nutrition, and National Seeds Corporation are located adjacent to the Institute.

2 Emblem and Invocation



2.1 Emblem

The Post Graduate School emblem is in the form of leaf representing the plant kingdom which is basic to agriculture. It is in colours : Red, Blue and Gold.

The EAR of wheat represents agriculture and plant sciences.

The MICROSCOPE signifies modern research.

The BOOK represents knowledge, including science basic to agriculture.

The motto is :
जीव जीवनं कृषि

"Agriculture is the supporter of life".

2.2 Invocation

Invocation song

The invocation song, sung at the annual convocation and other functions of the Post Graduate School, is reproduced on the next page :

शुनं नः फाला वि कृषन्तु भूमि।
    शनं कीनाशा अभियन्तु वाहैः।।
शुनं पर्जन्यो मधुना पयोभिः।
    शुगासींरा शुनमस्मासु धत्तम्।।
विज्ञानं ब्रह्मेति व्यजानात्।
    विज्ञानद्येव खल्विमानि भूतानि जायन्ते।।
विज्ञानेन जातानि जीवन्ति।
    विज्ञानं प्रयन्त्यभिसविशन्ति।।
विज्ञानं यज्ञं तनुते। कर्माणि तनुतेऽपि च।
    विज्ञानं देवाः सर्वे। ब्रह्मज्येष्ठमुपासते।।
तस्माच्वेन्न प्रमाद्यति
    शरीरे पाप्मनो हित्वा सर्वान्कामान्समश्नुते
अक्षेत्रवित् क्षेत्रविदं ह्यप्राट्
    सप्रैति क्षेत्रविदानुशिष्टः
एतद्वै भद्रं अनुशासनस्य।
    उत स्त्रुतिं विन्दत्यञ्जसीनाम्।
ऊंसहनाववतु। सह नौ भुनक्तु।
    सह वीर्य करवावहै।
तेजस्विनावधीतमस्तु। मा विद्विषाव है।
    ।।ॐ शांतिः शांतिः शांतिः।।

May the ploughshares till our land properly;
    May the ploughmen go happily with the oxen;
May the Rain God send us sweet showers at appropriate times;
    May *Suna* and *Sira* grant us prosperity.
Understand knowledge as *Brahman*;
    Because it is by knowledge alone that all these living being are born;
Having been born, by the knowledge they live;
    And having departed, into knowledge again they enter.
Knowledge is the fountain-head of sacrifice;

It stimulates all our actions;
All Gods worship knowledge as *Brahman*, the Highest;
If man does not swerve from the path of knowledge.
He attains all desires, having abandoned his sins in the body
One ignorant of the land asks him who knows about it;
And Advised by the teacher who knows, one (the pupil) goes forward.
This, verily, is the blessing of instruction;
One finds the path that leads straight forward (by oneself).
May He protect us. May he cause us to enjoy together;
May we exert together.
May learning make us radiant;
May we not hate one another.
Om, Peace, Peace, Peace!!!

3 Administration and Faculty

3.1 The Institute is a constituent unit of the Indian Council of Agricultural Research, which is a Society registered under the Societies Registration Act (Act XXI of 1860). The Director is the principal executive officer of the Institute. The Dean and Joint Director (Education) is responsible for the overall supervision of the programme of post-graduate education and training at the Institute.

3.2 The Institute has five main bodies which are responsible for broad policy matters and decision making in the field of research, post-graduate education and training, extension education and administration. They are :

(i) Board of Management
(ii) Research Council
(iii) Academic Council
(iv) Extension Council
(v) Executive Council

The highest policy making body of the Institute is the Board of Management. The Research Council is responsible for formulation of research projects and monitoring their progress and application. All the matters relating to post-graduate education and training are decided by the Academic Council which is supported by five Standing Committees and Board of Studies in various disciplines. The Extension Council is responsible to formulate the extension education and transfer of technology programme and to monitor the progress of extension education. All the administrative matters and policy decisions are implemented by the Executive Council. The composition of various bodies is as follows :

(a) *Board of Management*

The composition of the Board of Management is :

(i) Director — Chairman

(ii)	Dean and Joint Director (Education)	Member
(iii)	Joint Director (Research)	Member
(iv)	Joint Director (Extension)	Member
(v)	Two members of the Governing Body-nominated by the President, ICAR	Member
(vi)	Heads of Divisions/Heads of Department of related group of disciplines and Project Coordinators to be nominated by the President, ICAR by rotation for a period of two years-total number not to exceed eight	Member
(vii)	A Vice-Chancellor of an Agricultural University (to be nominated by the President, ICAR)	Member
(viii)	One representative from the ICAR (to be nominated by the Director-General)	Member
(ix)	Director, National Dairy Research Institute/Director, Indian Veterinary Research Institute (to be nominated by rotation for a period of two years by the Director-General)	Member
(x)	Agricultural Commissioner, Department of Agriculture	Member
(xi)	One eminent scientist in the field of research done in the Institute but not employed by ICAR (to be nominated by the President, ICAR for a period of two years)	Member
(xii)	One eminent educationist concerned with the research work of the Institute but not employed by ICAR (to be nominated by the President, ICAR for a period of two years)	Member
(xiii)	Two non-officials representing agricultural/rural interests (to be nominated by the President, ICAR)	Member
(xiv)	Financial Adviser, Indian Council of Agricultural Research or his nominee	Member
(xv)	Development Commissioner of Delhi Administration	Member
(xvi)	Joint Director (Admn.), IARI	Member-Secretary

(b) *Research Council*

The composition of the Research Council shall be as under :

(i)	Director	Chairman
(ii)	Joint Director (Research)	Member
(iii)	Joint Director (Extension)	Member
(iv)	Deputy Director-General (Crop Science) ICAR	Member

(v)	Four Managerial Scientists of the Institute (Project Directors/Heads of Divisions) one to represent each of the schools viz., Crop Production, Crop Protection, Crop Improvement and Social Sciences/Common Services (to be nominated for a period of two years by the Board of Management)	Member
(vi)	Five Scientists of the Institute, other than the Managerial Scientists (to be nominated by the Board of Management on a 2 year tenure basis)	Member
(vii)	One Project Coordinator (to be nominated for a period of two years by the Board of Management)	Member
(viii)	One Scientist from the Regional Research Station/other out-stations (to be nominated for a 2 year tenure period by the Board of Management)	Member
(ix)	Two eminent Scientists from outside the Institute (to be nominated by the Board of Management on a two-year tenure basis)	Member
(x)	Joint Director (Administration), IARI	Member
(xi)	Principal/Senior Scientist (RPC), IARI	Member-Secretary

(c) *Academic Council*

The composition of the Academic Council shall be as under :

(i)	Director	Chairman
(ii)	Dean & Joint Director (Education)	Vice-Chairman
(iii)	Joint Director (Research)	Member
(iv)	Joint Director (Extension)	Member
(v)	Deputy Director-General (Education), ICAR	Member
(vi)	Four eminent Scientists/educationists from outside the IARI distinguished in the field of education including agricultural education	Member
(vii)	All Professors of teaching disciplines, (or where there is no Professor the Head of the Division), Professor, NRL and Professor, WTC	Member
(viii)	Director, Indian Agricultural Statistics Research Institute, New Delhi	Member
(ix)	Master of Halls of Residences	Member
(x)	Two representatives from the Post-graduate Faculty	Member
(xi)	Two student Representatives	Member

(xii)	Joint Director (Administration)	Member
(xiii)	Registrar (Academic)	Member-Secretary

(d) *Extension Council*

The composition of the Extension Council shall be as under :

(i)	Director	Chairman
(ii)	Joint Director (Extension)	Member
(iii)	Joint Director (Research)	Member
(iv)	Deputy Director-General (Agricultural Extension), ICAR	Member
(v)	Four Managerial Scientists of the Institute (Project Directors/Heads of Divisions—one each representing the four Schools viz, Crop Production, Crop Protection, Crop Improvement and Social Sciences/Common Services (to be nominated for a period of 2 years by the Board of Management)	Member
(vi)	Five Scientists of the Institute (to be nominated by the Board of Management on a 2 year tenure basis)	Member
(vii)	One Project Coordinator (to be nominated for a period of two years by the Board of Management)	Member
(viii)	Director (Farm Information), Directorate of Extension or his nominee	Member
(ix)	One Scientist from the Regional Research Station/other out-stations (to be nominated by the Board of Management on a two year tenure basis)	Member
(x)	One representative of the Department of Agriculture, Ministry of Agriculture and Irrigation (to be nominated by the Agricultural Commissioner)	Member
(xi)	Two representatives of Delhi Administration (to be nominated by the Development Commissioner, Delhi Administration from the fields of Agriculture, Animal Husbandry, Irrigation and Drainage, Credit Marketing, etc.)	Member
(xii)	One Extension Scientist representing livestock development and Animal Health Cover (to be nominated by Director, National Dairy Research Institute/Director, Indian Veterinary Research Institute—appointment to be made on a 2 years tenure basis by the Board of Management)	Member
(xiii)	Joint Director (Administration), IARI	Member-Secretary

(e) *Executive Council*

The Executive Council comprises the following :

(i)	Director	Chairman
(ii)	Dean and Joint Director (Education)	Member
(iii)	Joint Director (Extension)	Member
(iv)	Joint Director (Research)	Member
(v)	Deputy Director-General (Crop Science), ICAR	Member
(vi)	Eight Managerial Scientists (Project Directors/Heads of Divisions) at least one from each of the four schools—Crop Production, Crop Protection, Crop Improvement and Social Sciences/Common Services (to be nominated by the Board of Management for a period of two years)	Member
(vii)	One representative of Project Coordinators (to be nominated by the Board of Management for a period of two years)	Member
(viii)	One representative from the Regional Research Station/ other out-stations (to be nominated by the Board of Management for a period of two years)	Member
(ix)	Joint Director (Administration)	Member-Secretary

Membership and Functions of Academic Council

3.3 The four eminent scientists/educationists will be nominated by the Chairman of the Academic Council on the recommendation of the Dean. The tenure of their membership is two years, the first two of them retiring through drawal of lots at the end of the first year.

3.4 The two representatives from the post-graduate faculty are elected through a process of an annual election by secret ballot by the faculty members. The following rules and procedure will be observed for election of the two faculty members to the Academic Council.

(i) All faculty members, other than those designated ex-officio as members of either the Board of Management or the Academic Council, will be eligible to be elected.

(ii) Members will normally be elected for a term of two years so that one vacancy is filled every year. A sitting member may only be re-elected for a second time in direct sequence but not for the third term.

(iii) In case a vacancy is caused on account of an elected member's ineligibility or inability to complete his term, election to fill the vacancy will be held in the prescribed manner for the remaining period of the term provided that the remaining period is not less than one year.

(iv) Nominations will be invited for each vacancy from faculty members. Each faculty member will be permitted to nominate one person and forward the nomination duly seconded, direct to the Dean or any other duly authorised officer of the P.G. School by name in a closed cover.

(v) The election will be by a secret, single non-transferable vote to be cast at the specified place on the specified date provided that the Faculty Members located at Regional Stations shall be permitted to cast their vote by post. The detailed instructions in this regard will be laid down by the Dean with the approval of the Chairman of the Academic Council and notified to all Faculty Members at least a month in advance of the date fixed for the polling.

(vi) Candidates receiving the highest number of votes shall be declared elected.

(vii) In case of a tie between two candidates, the issue will be settled by toss of coin after getting the agreement of both the candidates.

3.5 The two student representatives will be appointed in the following manner :

(a) The President, Post Graduate School Students' Union (PGSSU), IARI will be an ex-officio student representative in the Academic Council.

(b) The second student representative will be elected every year by secret ballot by the members of the PGSSU through the same election process adopted for electing the Executive of the Post Graduate School Students' Union.

(c) The tenure of the student representative shall be one year.

(d) In case of resignation of the student representative to the Academic Council, the vacancy would be filled by holding a re-election.

3.6 Any item suggested for inclusion in the agenda should reach the Post Graduate School Office at least 15 days in advance of the proposed date of the meeting of the Academic Council and no paper should be circulated in the last minute.

3.7 Agenda note for the meeting of the Academic Council shall normally be in the hands of the members at least one week in advance of the meeting. If a member has to make some clarifications on the agenda items, this may be made at the time of the meeting; in case the member is not in a position to attend the meeting, a written note expressing his views may be sent to the Chairman for consideration.

3.8 Members of the Academic Council who are not in a position to attend the meeting of the Council for unavoidable and exceptional reasons should formally seek prior leave of absence from the Chairman of the Academic Council.

3.9 The membership of the Academic Council is personal as the Academic Council discharges certain statutory functions. A member cannot depute his nominee to attend meetings of Academic Council on his behalf.

3.10 Membership of the Academic Council shall stand terminated on the happening of any of the following events :

(i) On the expiry of the period of membership for which nominated.

(ii) Death, resignation, lunacy or conviction for a criminal offence involving moral turpitude.

(iii) When a member himself declines to serve on the Academic Council or his employer refuses to grant him permission to serve on the Academic Council.

(iv) When a member does not attend three consecutive meetings of the Academic Council without proper leave of the Academic Chairman.

3.11 The Academic Council shall meet as often as necessary and in any event at least once in each trimester of the year, the year for this purpose being the academic year commencing from September and ending in August.

3.12 The Academic Council meeting shall be held on such date, time and place as may be determined by the Chairman.

3.13 All meetings of the Academic Council shall be called by notice in writing by and under the hand of the Member-Secretary.

3.14 Every notice calling the meeting of the Academic Council shall state the date, time and place of the meeting and shall be served upon every member of the Academic Council not less than 10 clear days before the day appointed for the meeting. However in case of an emergency the Academic Council meeting can be convened at a short notice giving clear 48 hours for the members to attend the meeting.

3.15 Any inadvertent omission to give notice, or non-receipt or late receipt of notice by any member shall not invalidate the proceedings of the meeting.

3.16 The draft proceedings of the meeting of the Academic Council will be circulated to all the members of the Academic Council for comments which should be communicated to the Post Graduate School office within a period of 10 days of such circulation. The comments, if any, will be placed for discussion at the next meeting of the Academic Council.

3.17 Proceedings of the meeting of the Academic Council shall also be circulated to Project Directors, Heads of Divisions and Regional Stations.

3.18 The proceedings of the Academic Council shall be placed in the very next meeting of the Board of Management for information.

3.19 It is the responsibility of each of the representative of the various Divisions to consult regularly with the Head of the Division and with post-graduate faculty of the Division, to keep them fully informed of actions of the Academic Council and of matters under discussion by the Academic Council. They are expected to bring to the attention of the Academic Council important views of the Divisions with respect to matters under discussion.

3.20 The powers and functions of the Academic Council shall be :

(i) The Academic Council shall be the main consultative, deliberative and task implementing body in the field of education and training.

(ii) The Academic Council shall be responsible for broad policy matters, on academic issues without dealing with individual cases.

(iii) The Academic Council shall have the control and general regulatory powers on matters relating to education and training.

(iv) The Academic Council shall be responsible for the maintenance of standards of instruction, education and examination within the P.G. School and shall exercise such other powers and duties as are conferred on it.

(v) The Academic Council shall be responsible for the determination of equivalence of degrees of candidates applying for admission from other universities, and shall be the final authority to make selection out of the applicants for admission.

(vi) The Academic Council shall perform in relation to academic matters, all such duties, as may be necessary, for the proper conduct of the programmes of post graduate education.

3.21 Standing Committees

3.21.1 The Academic Council has five Standing Committees for examining issues relating to education and training. The Standing Committees shall dispose of individual cases if they are within the frame-work of the rules and regulations in force. Cases of policy nature and which involve financial/administrative implications, shall be recommended and put up to the Academic Council with specific suggestions after examination from the financial and administrative angles. The recommendations of the Standing Committees shall be reported to the Academic Council for consideration.

3.21.2 The composition and functions of the Standing Committees as approved by the Board of Management are as under :

(i) *Standing Committee on Courses, Curricula and Academic Affairs*

Composition

Chairman : A Professor or a Project Director/Head of the Division who is a member of the Academic Council.

Members : Three Professors, an elected faculty representative in the Academic Council, the elected student representative in the Academic Council, and an official of the P.G. School (Convener).

Functions

(a) Review of academic standards including syllabi, examination, etc.

(b) Matters regarding admissions to Ph.D. and M.Sc. courses.

(c) Matters relating to examination, evaluation, teaching technique, etc.

(d) Criteria for formulation of new courses and recommendation of new courses for the approval of the Academic Council.

(e) Academic work-load of faculty members.

(f) Matters regarding major field of specialisation and subjects on which a degree has to be awarded.

(g) Rules regarding the award of degrees, IARI merit medals, etc.

(ii) *Standing Committee on Faculty, Students' Problems and Discipline*

Composition

Chairman : A Professor a Project Director/Head of the Division who is a member of the Academic Council.

Members : Three Professors, Master of Halls of Residences, Joint Director (Administration), Second elected Faculty Representative in Academic Council, President, PGSSU, and an official of P.G. School (Convener).

Functions

(a) Formulation of guidelines regarding admission of faculty members, their duties, obligations and other related faculty matters.

(b) Guidelines regarding the composition and function of the Board of Studies and Faculty in each discipline.

(c) To deal with representations from individual faculty member regarding allotment of students, constitution of Advisory Committees, teaching of course, representation in Board of Studies, grant of laboratory and other facilities.

(d) Representations from students regarding the constitution of Advisory Committees, dropping/adding of courses, relief from P.G. School, maximum period of absence on leave, removal of names from the rolls of the P.G. School, etc.

(e) Use of Institute facilities in terms of equipment, chemicals, etc., by students.

(f) Cases relating to students' discipline.

(iii) *Standing Committee on Scholarships, Financial Assistance and Academic Progress*

Composition

Chairman : A Professor or a Project Director/Head of the Division who is a member of the Academic Council.

Members : Three Professors, President, PGSSU, the elected Student Representative in Academic Council and an official of the P.G. School (Convener).

Functions

(a) Procedure for reviewing the academic progress of students.

(b) Individual cases of students regarding extension of time limit for submission of thesis and also cases of poor academic progress.

(c) Formulation of terms and conditions for the award of various scholarships and fellowships.

(d) Award of scholarships.

(e) Procedure for assistance from Students' Welfare Fund.

(iv) *Standing Committee on Students' Welfare, Board and Residence*

Composition

Chairman : A Professor or a Project Director/Head of the Division who is a member of the Academic Council.

Members : Three Professors, Master of Halls of Residences, Joint Director (Administration), President, PGSSU, the elected student representative in Academic Council, and an official of the P.G. School (Convener).

Functions

(a) Review of amenities in the hostel including food services.

(b) Organisation of co-curricular and extra-curricular activities.

(c) Rules regarding hostels including guests, overstayal, etc.

(d) Placement of students for employment.

(e) Medical attendance.

(v) *Standing Committee on Inter-Disciplinary Facilities and Instructions*

Composition

Project Director, NRL; Project Director, WTC; Head, Agricultural Engineering; Head, Biochemistry; Head, Soil Science & Agril. Chemistry; Head, Agril. Physics; Head, Genetics; Professor, WTC; and Professor, NRL.

The chairmanship of this Committee will be held by the Project Director, NRL and Project Director WTC on rotational basis for two years.

Functions

(a) Coordination of teaching with the concerned Divisions in respect of the multi-disciplinary units.

(b) Allotment of students and organisation of courses relating to the multi-disciplinary units in the parent discipline.

(c) Use of facilities available in the multi-disciplinary units.

The tenure of these Committees is 2 years.

3.21.3 The members of various Standing Committees shall be nominated by the Chairman, Academic Council and the nominations are placed before the Academic Council for approval at the time of reconstitution of the Committees once in two years. The Chairman is empowered to fill up casual vacancies occurring during the life of these Committees.

3.22 Post Graduate Faculty

The Post Graduate Faculty consists of the following :

(i) Dean, Post Graduate School	Chairman (ex-officio)
(ii) Director, IARI	Member (ex-officio)
(iii) All Project Directors and Heads of the Divisions	Members (ex-officio)
(iv) All Professors	Members (ex-officio)
(v) Other officers of the Institute who are specifically approved for inclusion in the Post Graduate Faculty as per norms prescribed in this regard	Members
(vi) Registrar (Academic)	Member-Secretary (ex-officio)

(a) The Faculty may consider or report on any matter referred to it by the Academic Council, the Board of Management or the members of the Faculty.

(b) The meetings of the Post Graduate Faculty are generally held 3 to 4 times in a year or as often as necessary.

(c) All Visiting Professors will automatically be recognised as members of the faculty provided their curriculum vitae is forwarded to the Dean sufficiently in advance of the date of arrival.

(d) The Academic Council may in special cases, second distinguished scientists to the Post Graduate Faculty.

3.22.1 *Nomination to the Post-Graduate Faculty*

All scientists including those working at Regional stations of IARI and who satisfy the following qualifications are eligible to apply for membership of the Faculty.

3.22.2 *Faculty membership requirements*

(i) A Master's degree in the discipline concerned with minimum II Class or equivalent grade, and similar grade in the Bachelor's degree also as the basic qualification.

Note : The scientists who obtained 3rd division in B.Sc. or M.Sc. but have to their credit excellent research work published in professional journals of repute or have distinguished themselves in teaching, can also be considered for induction in faculty.

(ii) Ph.D. with 3 years post-Ph.D. research/teaching/extension experience as Scientist S-1 or equivalent capacity or Master's degree or B.Tech. (only in case of Agril. Engineering discipline) with 6 years post M.Sc. or post B.Tech. research/teaching/ extension experience as Scientist S-1 or equivalent capacity.

(iii) Five research papers in professional journals of repute in the concerned discipline with senior or sole authorship in at least 3 of them.

(iv) A seminar on his contribution to be given by the applicant in a faculty meeting; BOS will assess his/her suitability. If the Board of Studies feels that the requirement of giving a seminar should be waived off in any particular case, a reference may be made to the Dean with the recommendations/justifications for granting such exemption.

(v) BOS will give full justification with specific recommendation whether applicant's induction to the faculty will add to the efficiency of the teaching programme in the discipline.

(vi) The scientists while applying for induction into the P.G. Faculty should enclose attested copies of all degrees (B.Sc., M.Sc., Ph.D.) certificates and also the reprints of all the research papers (at least the required numbers) published by them for the perusal to the Board of Studies and also for the Standing Committee on Faculty, Students problems and discipline. (The papers published in the proceedings of the symposium can also be considered as Research Papers, provided these contain research findings and are not review articles).

Untill they become eligible for research guidance as envisaged below, scientists inducted into the faculty can serve as members of the Advisory Committees of the students representing the respective major or minor field as the case may be, but will not be eligible to function as Chairman of the Advisory Committee of the Student.

3.22.3 *Research guidance*

(i) A faculty member should have put in at least 3-5 years teaching experience (3 years for M.Sc. guidance and 5 years for Ph.D. guidance) either as Course Leader or Course Associate after induction into the Faculty and should have published at least 3-5 research papers (3 for those who want to guide M.Sc. students and 5 for those who want to guide Ph.D. students) in professional journals of repute with senior or sole authorship in at least 2 of them, during this period. (For computing teaching experience, teaching for at least one trimester in the year will be taken as one year experience). Staff members who have guided students in other Universities prior to their appointment in IARI are eligible to apply for Research Guide.

(ii) Those with only Master's degree will be eligible to guide only M.Sc. students.

(iii) Those with Ph.D. degree will be eligible to guide Ph.D. students only after they have guided 2 M.Sc. students. However, the Dean may permit a faculty member, who have not guided 2 M.Sc. students, to guide Ph.D. students in relaxation of existing guidelines in each of those disciplines where there is no M.Sc. degree programme.

(iv) Those with Master's degree by course work alone will not be eligible to guide any research students until they acquire a Ph.D. degree.

3.22.4 *Faculty membership of Library Staff*

The qualifications for library staff for induction as faculty member of the Institute shall be as under :

(i) A Master's degree in Library Science with minimum second class or equivalent grade, and a similar grade in the Bachelor's degree also as the basic qualification.

(ii) 6 years experience as Librarian with 5 publications in journals of library science or 8 years experience as Librarian (in lieu of publications).

(iii) In the case library staff who do not fulfil the above qualifications but have exceptional experience they can also be considered for induction into faculty provided they have a Master's degree in science and a diploma in Library Science.

3.22.5 If any Faculty member is admitted as a departmental student of the Post Graduate School or is registered for a higher degree with an outside university, his faculty membership will stand automatically discontinued. During his/her studentship he/she will not be eligible to teach courses or guide students either as a chairman or a member of the Advisory Committee. A member of faculty who applies for registration for "Higher Degree" with an outside university, will cease to be a faculty member on expiry of 6 months from the date on which his/her application is forwarded by the Dean, P.G. School or from the date he/she is actually registered with the outside university, whichever is earlier. It would be the responsibility of the faculty member concerned to inform the Professor and the Dean immediately on receipt of intimation of his registration with an outside university. The provision of this rule would not be applicable to a member of faculty registered with an outside university for a post-doctoral degree.

3.22.6 If a staff member had been a student of the Post-Graduate School and his/her name had been struck off for not maintaining the minimum required G.P.A., he/she will not be eligible for faculty membership. If the staff member had also a faculty membership before his/her admission to the P.G. School and his/her name was struck off for not maintaining the required G.P.A., his/her faculty membership shall not be revived.

3.22.7 A faculty member shall ordinarily function as the Chairman of the Advisory Committee of not more than 3 students and in any case of not more than 4 students.

3.22.8 A faculty member shall function as a member of the Advisory Committee of not more than 10 students. This shall be in addition to the limit of 3 students mentioned in Para 3.22.7.

3.22.9 No faculty member/staff member shall function as a guide for any candidate registered with another university. However, the faculty members located at the Regional Stations are allowed to take up the guidance work of only such students as are registered as full time students at a local agricultural university, provided that :

(i) the Faculty Member certifies that he/she can undertake the guidance work without prejudice, in any way, to his/her approved research programme at the Regional Station;

(ii) he/she obtains the prior permission of the Director, IARI, through the P.G. School before communicating his/her consent for, or undertaking guidance of any such student and

(iii) the student undertakes to acknowledge the facilities extended by the IARI in his/her thesis.

3.22.10 The maximum number of courses under the charge of each faculty member will be two in an academic year. In exceptional cases, a faculty member may be made in charge of three courses with the permission of the Dean. Ad-hoc teaching responsibility may be granted to a member of the staff on an annual basis.

3.23 Faculty guidelines

3.23.1 The following guidelines have been prescribed by the Academic Council with a view to ensure smooth and uninterrupted programme of teaching and guidance of post-graduate students at a high level :

(i) As research and post-graduate teaching functions are integrated at IARI, all the faculty members will give equal importance to research work and teaching and guidance of post-graduate students.

(ii) The Head of the Division/Project Director/Project Coordinator should carefully examine, in consultation with the Professor, the commitments of the faculty member with regard to the guiding of students and teaching of courses before sanctioning tour programme, leave, deputation abroad or relieving him for accepting other jobs etc. The permission of the Dean may be sought for any absence exceeding three months. While seeking this permission the commitments involved and the alternative arrangements made should be indicated.

(iii) All the members of the Advisory Committees of the students should refrain from going on long tours during the period when the students are expected to finalize their thesis, if such tours are likely to delay the finalization of the theses. Short unavoidable tours may be undertaken in such a way that the submission of thesis is not delayed.

(iv) Except for minor adjustments, a course instructor should not drop or suspend any class as per the approved time-table on account of meetings, workshops, selection committees, etc. in IARI, ICAR or outside. Such invitations/engagements may be declined, if they interfere with the commitments of the faculty members.

(v) Every course instructor shall submit the result of examination at the end of the trimester within 7 days of the date of holding the final examination. The reason for delay, if any, should be clearly explained.

(vi) A faculty member leaving the Institute and taking up another temporary assignment elsewhere should take prior approval of the Dean for temporarily discontinuing the faculty membership. The faculty member, on return from his/her assignment, should send a formal intimation to the Professor and the Dean, and would be automatically included in the faculty list.

3.23.2 The following guidelines have been prescribed in regard to teaching and guidance of the post-graduate students by faculty members located outside the Division relating to their parent discipline :

(i) The faculty members, irrespective of their location, shall belong to their parent discipline.

(ii) They shall be eligible to teach courses, to become chairman or member of the students' Advisory Committees and to become members of the Board of Studies of the discipline. There shall be no distinction for any purpose between the faculty member located outside the Division and faculty member located inside the Division in respect of post-graduate eduction and teaching.

(iii) They shall be eligible for being given the responsibility for teaching a course including designation as course leader.

(iv) Matters such as courses to be taught by the faculty members shall be decided by Board of studies in each discipline well in advance. The Professor of parent discipline (or the Head of the Division concerned where there is no Professor) may ascertain from the Head of the establishment where the faculty member is located, the commitments of the particular faculty member. If such a faculty member is not in a position to teach courses or guide students during a particular period, this shall be intimated sufficiently in advance to the Professor/Head of the Division relating to the parent discipline. Details regarding the background of the faculty member and of the courses previously taught by him/her shall be kept in view by the faculty while allotting the courses to such faculty member.

(v) In order to ensure that the faculty members are fully committed to the responsibility of post-graduate education and teaching in a particular discipline, the Professor of the parent discipline or the concerned Head of the Division where there is no Professor, shall assess annually the performance of the faculty member so far as his/her work relating to teaching of courses and guiding of students are concerned. The assessment in respect of work other than teaching of courses and guiding of students shall be made by the immediate supervisory officer of the Unit/Division/ Centre where the faculty members are working. However, in respect of faculty members in whose case the assessment for research work is now done directly by the Director, the assessment for work relating to teaching of courses and guiding students shall also be done directly by the Director.

3.24 Issue of directions, clarifications etc. in special circumstances on behalf of the Academic Council.

(i) If a situation arises in which it is expedient to issue authoritative clarifications or directions on behalf of the Academic Council with a view to ensuring smooth and uninterrupted conduct of academic activity at the Institute and it is not practicable to convene its meeting immediately, the Chairman of the Academic Council may, in consultation with the Chairman of the Post Graduate Faculty of the Institute and the Chairman of the Standing Committee(s) concerned, issue necessary clarifications or directions, and these shall have effect as if made by the Academic Council and shall continue to be in force until revoked or modified by the Academic Council after consideration at its meeting later.

(ii) All such clarifications or directions shall as far as practicable, be reported to the

Academic Council for ratification at its next regular meeting (including a postponed meeting) or a meeting specially convened, *inter alia* for this purpose.

3.25 Board of Studies

3.25.1 Each discipline shall have a Board of Studies. It shall be constituted and shall function in the manner herein specified :

(a) The members of the Boards of Studies will be nominated by the Dean at the commencement of each academic year in consultation with the Professor and the Head(s) of the Division(s) concerned. While making nominations, the Dean will strive to provide representation to the scientists belonging to the various grades of scientists having regard to their inter-seniority. The Dean may nominate a relatively junior scientist-member of a grade, keeping in view the academic interests, the advice of the Professor/Head(s) concerned and also the need for providing representation to all the areas of specialisation covered by the discipline. The decision of the Dean in the matter shall be final and will not be called in question. Subject to these stipulations each Board will consist of the following members :

(i)	Professor	Chairman (Ex-Officio)
(ii)	Head of the Division	Member (Ex-Officio)
(iii)	Three Scientists representing different categories such as Scientist; Scientist (SG); Senior Scientist; and Principal Scientist	Member
(iv)	One student representative	Member

(b) Only the scientists who are members of the P.G. Faculty of the concerned discipline, shall be eligible to be included in the Board of Studies. The members of the Faculty posted at the Regional Stations, i.e. outside Delhi, shall not be nominated to the Board of Studies as it will be generally difficult for them to attend the meetings of the Board of Studies.

(c) One of the non-permanent scientist members of the Board of Studies shall be nominated as Member-Secretary by the Chairman.

(d) The student representative should preferably be a Ph.D. student in the third year of his/her studies and will be nominated normally on the advice of the students club/society of the discipline concerned. The Dean may, however, nominate any other student at his discretion if he is of the opinion that the student representative suggested by the Students' club/society is not likely to make/is not making any useful contributions to the deliberations at the meetings of the Board of Studies concerned in an orderly manner:

(e) The Board of Studies may co-opt an additional member or decide to specially invite any Scientist of the discipline to help it in its deliberations. Such co-opted member(s)/invitee(s) shall have no right of vote :

(f) The non-permanent members shall retire every year. The Dean, however, will have the power to renominate a retiring member.

(g) Where there is no other Scientist belonging to a category in a faculty except the one already included in the Board of Studies, such scientist shall continue to be included in the Board of Studies despite the expiry of his/her term.

(h) Dean may nominate another member in the Boards of Studies in lieu of the one already nominated by him if in his opinion the member already nominated is not taking adequate interest in the proceedings of the Boards of Studies or his conduct at the meeting of the Boards of Studies is such as to hinder the smooth functioning of the Board of Studies concerned.

(i) As far as practicable the Professor shall decide the date, time and place of holding of the meeting of the Board of Studies in consultation with the Head of the Division concerned, and but for exceptional reasons a notice of 7 clear days shall be given for holding of meeting of the Board of Studies. While the quorum for holding of the meeting of the Board of Studies shall be 75% of the total membership of the Board, no quorum will be needed for holding an adjourned meeting provided due notice has been given of the date and time for holding the adjourned meeting.

(j) Each Board of Studies shall be re-constituted by the end of August preceding the commencement of the new academic year.

3.25.2 The Board of Studies shall have the responsibility of reviewing the instructional programme of the discipline concerned in respect of each trimester, preparing recommendations for revision, addition or deletion of curses, organisation of the teaching of courses in each trimester in the discipline concerned and considering all matters relating to improvement and conduct of Post Graduate School. The executive responsibility for implementation will be that of the Professor and the Head of the Division concerned.

3.25.3 The Board of Studies shall meet as often as necessary, but at least once at the end of each trimester to review progress of students, conduct of courses in the previous trimester and the other academic matters.

3.26 Post Graduate School Administration

Director	S.K Sinha
Dean and Joint Director (Edn.)	N.N. Goswami
Joint Director (Admn.)	Vacant
Registrar (Academic)	A.K. Chaturvedi
Asstt. Administrative Officer	Nathi Singh
Asstt. Administrative Officer	Bhagwati Prasad
Medical Officer	Harminder Kaur (Mrs.)
Master of Halls of Residences	R.P. Johri

Associate Warden	—
Associate Warden	—
Associate Warden	N.P.S. Sirohi
Associate Warden	N.T. Yaduraju
Foreign Students' Advisor	Anupam Varma
Lady Students' Advisor	Binita Sen (Mrs.)
Sports Advisor	—

3.27 Post Graduate Faculty

Sinha, S.K. B.Sc., M.Sc., Ph.D. (Alberta), Ph.D. (Agra)	Director, IARI
Goswami, N.N. B.Sc. (Ag.) Hons., Assoc. IARI, Ph.D.	Dean & Joint Director (Education) and Chairman of the Faculty

Agricultural Chemicals

Agnihotri, N.P.
B.Sc. (Ag.), M.Sc. (Ag.), M.S., Ph.D.

Devakumar, C.
M.Sc., Ph.D., F.I.C.S.

Dikshit, A.K.
B.Sc., M.Sc., Ph.D.

Dureja (Miss), P.
B.Sc., M.Sc., Ph.D.

Gopal, M.
M.Sc., D.Phil, Ph.D.

Gupta, R.L.
B.Sc. (Hons.), M.Sc., Ph.D.

Handa, S.K.
B.Sc., M.Sc., Ph.D.

Jain, H.K.
Ph.D.

Khazanchi, R.
M.Sc., Ph.D.

Kulshrestha, (Mrs.), G.
B.Sc. (Hons.), M.Sc., Ph.D.

Parmar, B.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Roy, N.K.
B.Sc. (Hons.), M.Sc., Ph.D., F.I.C.

Saxena, D.B.
B.Sc., M.Sc., Ph.D.

Singh, R.P.
B.Sc. (Hons.), M.Sc., Ph.D.

Tomar, S.S.
B.Sc. (Hons.), M.Sc., Ph.D.

Walia, Suresh
M.Sc., M.Phil, Ph.D.

Agricultural Economics

Atteri, B.R.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Das, Shiv Ram
M.A. (Econ.), Ph.D.

Kumar, P.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Mruthyunjaya
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Pal, Suresh
B.Sc., M.Sc., Ph.D.

Pandey, R.K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Selvarajan, S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sharma, B.M.
B.Sc. (Hons.) Ag., M.Sc., Ph.D.

Singh, Chhotan
B.Sc., M.A., Ph.D.

Singh, Ikbal
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, R.P.
B.Sc., M.Sc., Ph.D.

Singh, Parmatma
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Agricultural Engineering

Arya, Y.C.
B.Sc. (Ag. Engg.), M.Sc.

Bhattacharya, A.K.
B.Sc. (Ag. Eng. Tech.), M. Tech., Ph.D.

Chandra, P.
B.Tech, M.Tech, Ph.D.

Ilyas, S.M.
B.Tech, M.Tech, Ph.D.

Kalra, M.S.
B.Tech, M.Sc.

Khanna, S.K.
B.Sc. (Ag. Engg.), M.Sc. (Ag. Engg.)

Kumar, Ashwani
B.Sc. (Ag. Engg.), M.Tech., Ph.D.

Nag, D.
B.Tech, M.Tech

Panwar, J.S.
B.Tech, M.S., Ph.D.

Rajput, T.B.S.
B.Tech, M.Tech, Ph.D.

Rao, N.H.
B.Sc. (Hons), M.Sc., Ph.D.

Samuel, D.V.K.
B.Sc. (Ag. Engg.), M.Tech, Ph.D.

Sarma, P.B.S.
B.E. (Civil Engg.), M.E. (Power Engg.), I.I.Sc., Ph.D.

Sarkar, T.K.
B.Sc. (Ag. Engg.), DIIT, Ph.D.

Singhal, O.P.
B.Tech, P.G. Diploma (Engg.), Ph.D.

Singh, Akshayaber
B.Tech, M.Tech (S&WCE), Ph.D.

Singh, Amar
B.Sc. (Ag.), B.Sc. (Ag. Engg.), M.Tech

Sirohi, N.P.S.
B.Tech, M.Tech, (F.M&P), Ph.D.

Srivastava, A.P.
B.Sc., M.Tech, Ph.D.

Tandon, S.K.
B.Sc., M.Sc., Ph.D.

Agricultural Extension

Bhagat, Rekha
Ph.D.

Bhatt, C.M.
Ph.D.

Ramesh Babu, A.
Ph.D.

Singh, Baldeo
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, R.P.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, Y.P.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sinha, B.P.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Vijayaragavan, K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Agricultural Physics

Arora, R.P.
B.Sc. (Hons), M.Sc. (Ag.), Ph.D.

Bhavanarayana, M.
B.Sc., M.Sc., Ph.D.

Chakravarty, N.V.K.
M.Sc. (Tech), Ph.D.

Chandrasekharan, H.
B.Sc., M.Sc., Ph.D.

Chopra (Mrs.), U.K.
B.Sc. (Hons), M.Sc., Ph.D.

Das, D.K.
B.Sc. (Ag.), M.Sc., Ph.D.

Gambhir, P.N.
B.Sc., M.Sc., Ph.D.

Gupta, R.P.
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Joshi, R.C.
B.Sc., M.Sc., Ph.D.

Kalra, Naveen
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Khwas, Bhagwat
B.Sc. (Hons), M.Sc.

Moharir, A.V.
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(Dr. Sc. Agr.)

Sundarasarma, K.S.
B.Sc., M.Sc., Ph.D.

Sastri, C.V.S.
B.Sc., M.Sc. (Tech), Ph.D.

Sastry, P.S.N.
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Singh, A.K.
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Singh, Surendra
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Yaduraju, R.P.
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Biochemistry

Chatterjee, S.R.
M.Sc., Ph.D.

Gupta, H.O.
B.Sc., M.Sc., Ph.D.

Johari, R.P.
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Kapoor, H.C.
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B.Sc. (Ag.), M.Sc. (SSAC), Ph.D.

Madan, T.R.
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Mathur, J.M.S.
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Mehta, S.L.
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Raman, T.S.
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Santha, (Mrs.) I.M.
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Sastry, L.V.S.
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Singh, Prikshayat
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Singh, S.P.
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Srivastava, K.N.
B.Sc., M.Sc., Ph.D.

Varade, P.B.
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Computer Application

Doshi, S.P.
M.Sc. (Stat)

Dutta, O.P.
M.A. (Maths)

Gopalan, R.
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Mahesh Kumar
M.Sc. (Maths), Statistician Diploma

Malhotra, P.K.
B.Sc., M.Sc. (Ag. Stat.), Ph.D.

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Entomology

Anand, (Mrs.) Chander Mohini
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Atma Ram
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Bhatia, (Mrs.) P.
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Bisht, Dan Singh
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Chaudhari, S.
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Dhingra, (Mrs.) Swaran
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Farooqi, S.I.
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Garg, A.K.
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Ghai, (Miss) S.
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Gautam, R.D.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Gujar, G.T.
B.Sc. (Ag.), M.Sc. (Ent.), Ph.D.

Gupta, G.P.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Gupta, Meera
B.Sc. (Hons.), M.Sc., Ph.D.

Katiyar, K.N.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Kumar, Sunil
B.Sc. (Hons.), M.Sc. (Hons.)

Lal, O.P.
B.Sc., M.Sc., Ph.D.

Mahto, Yogendra
B.Sc., M.Sc., Ph.D.

Marwaha, K.K.
B.Sc. (Hons.) Ag., M.Sc. (Ent.), Ph.D.

Mathur, L.M.L.
B.Sc., M.Sc., Ph.D.

Mohd., Naim
B.Sc., M.Sc., Ph.D.

Pant, J.C.
B.Sc., M.Sc., Ph.D.

Panwar, V.P.S.
B.Sc., M.Sc., Ph.D.

Paul, A.V.N.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Phadke, K.G.
B.Sc., M.Sc., Ph.D.

Phokela, (Miss) A.
B.Sc., M.Sc., Ph.D.

Prasad, H.H.
B.Sc., M.Sc., Ph.D.

Prasad, S.K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Prem Kishore
B.Sc., M.Sc., Ph.D.

Ramamurthy, V.V.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Ramakrishnan, N.
B.Sc., M.Sc., Ph.D.

Ramakrishnan, (Mrs.) Usha
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Rao, P.J.
B.Sc., M.Sc., Ph.D.

Saxena, J.D.
B.Sc., M.Sc., Ph.D.

Sharma, V.K.
B.Sc., M.Sc., Ph.D.

Siddiqui, K.H.
B.Sc., M.Sc., M. Phil., Ph.D.

Singh, Daya Shankar
B.Sc., M.Sc., Ph.D.

Singh, K.M.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, R.N.
B.Sc., M.Sc., Ph.D.

Singh, R.P.
B.Sc., M.Sc., Ph.D.

Singh, Vidya Sagar
B.Sc., M.Sc., Ph.D.

Singh, Vijai Shankar
B.Sc., M.Sc., Ph.D.

Singh, Yashbir
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sircar, P.
B.Sc. (Hons.), M.Sc., Ph.D.

Srivastava, B.G.D.
B.Sc., M.Sc., Ph.D.

Srivastava, K.L.
B.Sc., M.Sc., Ph.D.

Srivastava, K.P.
B.Sc., M.Sc., Ph.D.

Srivastava, M.L.
B.Sc., M.Sc.; Ph.D.

Srivastava, Y.N.S.
B.Sc., M.Sc., Ph.D.

Subramanyam, B.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sukhani, T.R.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Verma, (Mrs.) Shashi
B.Sc. (Hons.), M.Sc., Ph.D.

Yadav, T.D.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Genetics

Ahuja, V.P.
Ph.D.

Arunachalam, V.
B.A. (Hons.), M.A., Ph.D.

Chakrabarti, S.N.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Chandrashekaran, S.
Ph.D.

Chowdhury, S.
Ph.D.

Govil, J.N.
B.Sc., M.Sc., Ph.D.

Govila, O.P.
B.Sc., M.Sc., Ph.D.

Gulati, S.C.
B.Sc., M.Sc., Ph.D.

Kalia, C.S.
Ph.D.

Krishan Kant
B.Sc., M.Sc., Ph.D.

Katiyar, R.K.
B.Sc., M.Sc., Ph.D.

Khamankar, Y.G.
B.Sc., M.Sc., Ph.D.

Kulshrestha, V.P.
Ph.D.

Malik, R.S.
Ph.D.

Manchanda, P.L.
B.Sc. (Hons.) Ag., M.Sc., Ph.D.

Mangath, K.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Mehra, R.B.
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Mukherjee, B.K.
B.Sc. (Hons.), Assoc. IARI, Ph.D.

Narula, P.N.
B.Sc., M.Sc., Ph.D.

Pandey, H.N.
B.Sc., M.Sc., Ph.D.

Raghavaiah, P.
B.Sc., M.Sc., Ph.D.

Raut, R.N.
B.Sc. (Ag.), M.Sc., Ph.D.

Rawat, D.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sachan, J.K.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Saini, H.C.
Ph.D.

Sarkar, K.R.
B.Sc. (Ag.), M.Sc., Ph.D.

Sarla, (Mrs.) N.
Ph.D.

Shanker, Kirpa
B.Sc. (H.), M.Sc., Ph.D.

Sharma, Balram
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singhal, N.C.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, Dalmir
Ph.D.

Singh, N.N.
B.Sc., M.Sc., Ph.D.

Singh, R.D.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, S.P.
B.Sc., M.Sc., Ph.D.

Singh, S.R.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, Vijai Pal
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Srivastava, P.S.L.
B.Sc., M.Sc., Ph.D.

Tyagi, M.C.
Ph.D.

Upadhyay, M.K.
B.Sc., M.Sc., Ph.D.

Yadav, S.P.
B.Sc., M.Sc., Ph.D.

Zaman, F.U.
Ph.D.

Horticulture

Bhattacharya, S.K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Chakrabarty, A.K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Choudhary, M.L.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Dadlani, N.K.
B.Sc. (Ag.), M.Sc., Ph.D.

Dohare, S.R.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Goswami, A.M.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Jindal, P.C.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Kalda, T.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Kataria, A.S.
Ph.D.

Khanna, R.C.
B.Sc. Ag. (Hons.), M.Sc.

Khurdiya, D.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Kishore, D.K.
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B.Sc., M.Sc., Assoc. CFTRI, Ph.D.

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More, T.A.
B.Sc., M.Sc., Ph.D.

Pal, Netra
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Pal, R.K.
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Raghava, S.P.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

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B.Sc. (Bot.) Hons., M.Sc. (Bot.), Ph.D.

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B.Sc. (Hons. Ag.), M.Sc. (Hort.), Ph.D.

Sharma, H.C.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sharma, R.K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sharma, R.R.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sharma, V.P.
B.Sc., M.Sc., Ph.D.

Singh, Brijendra
B.Sc. (Ag.), M.Sc., Ph.D.

Singh, Narendra
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, Room
B.Sc. (Ag.), M.Sc., Ph.D.

Sirohi, P.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Thakur, P.C.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Tiwari, R.N.
B.Sc., M.Sc., Ph.D.

Verma, T.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Verma, V.K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Microbiology

Balasundram, B.R.
B.Sc., M.Sc., Ph.D.

Gaur, Y.D.
B.Sc., M.Sc., Ph.D.

Goyal, S.K.
B.Sc., M.Sc., Ph.D.

Gulati, S.L.
B.Sc., M.Sc., M.Sc. (Tech), Ph.D.

Jauhari, K.S.
B.Sc., M.Sc., Ph.D.

Kaushik, B.D.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Kavimandan, S.K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Magu, S.P.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Mathur, R.S.
B.Sc., M.Sc., Ph.D.

Sadasivam, K.V.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Shende, S.T.
B.Sc. (Ag.), M.Sc., Ph.D.

Singh, C.S.
B.Sc. (Hons.), M.Sc., Ph.D.

Tilak, K.V.B.R.
B.Sc., M.Sc., Ph.D.

Molecular Biology and Bio Technology

Bansal, H.C.
M.Sc., Ph.D.

Chopra, V.L.
B.Sc. (Hons.) Ag., Assoc. IARI, Ph.D.

Grover, (Mrs.) Anita
Ph.D.

Gupta, Narendra
B.Sc. (Hons.), M.Sc., Ph.D.

Jain, Jagrati
M.Sc., Ph.D.

Kashyap, L.R.
M.Sc., Ph.D.

Khanuja, S.P.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Kriti, P.B.
B.Sc., M.Sc., Ph.D.

Koundal, K.R.
B.Sc. (Ag.), M.Sc., Ph.D.

Prakash, Shyam
B.Sc., M.Sc., Ph.D.

Raina, S.K.
M.Sc., Ph.D.

Sharma, R.P.
B.Sc., M.Sc., Ph.D.

Singh, Aqbal
M.Sc., Ph.D.

Srinivasan
M.Sc., Ph.D.

Mycology and Plant Pathology

Agarwal, D.K.
B.Sc., M.Sc., Ph.D.

Agarwal (Mrs.), R.P.
B.Sc. (Hons.), M.Sc., Ph.D.

Ahlawat, Y.S.
B.Sc., M.Sc., Ph.D.

Bahadur, P.
B.Sc., M.Sc., Ph.D.

Bahl, (Mrs.) Nita
B.Sc., M.Sc., Ph.D.

Choudhry, P.N.
B.Sc., M.Sc., Ph.D.

Dhingra, K.L.
B.Sc., M.Sc., M.Phil., Ph.D.

Dinesh Kumar
B.Sc. (Hons.), M.Sc., Ph.D.

Durgapal, J.C.
B.Sc., M.Sc.

Gaur, Ashok
B.Sc., M.Sc., Ph.D.

Giri, B.K.
B.Sc., M.Sc., Ph.D.

Gupta, J.P.
B.Sc., M.Sc., Ph.D.

Gupta, (Miss) M.D.
B.Sc., M.Sc., Ph.D.

Jain, R.K.
B.Sc., M.Sc., Ph.D.

Jindal, J.K.
B.Sc., M.Sc., Ph.D.

Kapoor, I.J.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Kulshrestha, D.D.
B.Sc., M.Sc., Ph.D.

Lal, (Miss) S.P.
B.Sc., M.Sc., Ph.D.

Mitra, D.K.
B.Sc. (Ag.), M.Sc., Ph.D.

Mahinder Pal
B.Sc. (Hons.), M.Sc., Ph.D.

Niazi, F.R.
B.Sc., M.Sc., Ph.D.

Pandey, K.R.
B.Sc. (Hons.), M.Sc., Ph.D.

Pillai, (Mrs.) P.K.
B.Sc., M.Sc., Ph.D.

Ramachandran, (Mrs.) P.
B.Sc. (Hons.), M.Sc., Ph.D.

Rangaraju, R.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Roy, M.K.
B.Sc., M.Sc., Ph.D.

Sahni, M.L.
M.Sc., Assoc. IARI, Ph.D.

Sangam Lal
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Sarbhoy, A.K.
B.Sc., M.Sc., Ph.D.

Sen, (Mrs.) B.
B.Sc. (Hons.), M.Sc., Ph.D.

Sharma, R.C.
B.Sc., M.Sc., Ph.D.

Sharma, S.K.
B.Sc., M.Sc., Ph.D.

Shukla, (Ms.) Pratibha
B.Sc., M.Sc.

Singh, D.V.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, R.H.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, R.P.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, T.B.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Srivastava, K.D.
B.Sc., M.Sc., Ph.D.

Summanwar, A.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Varma, Anupam
B.Sc., M.Sc., Ph.D.

Varshney, J.L.
B.Sc., M.Sc., Ph.D.

Verma, J.P.
B.Sc., M.Sc., Ph.D.

Verma, V.S.
B.Sc., M.Sc., Ph.D.

Nematology

Chawla, M.L.
B.Sc. (Hons.), M.Sc., Ph.D.

Dasgupta, D.R.
B.Sc. (Ag.), M.Sc., Ph.D.

Dhawan, S.C.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Ganguly, A.K.
B.Sc., M.Sc., Ph.D.

Ganguly, (Mrs.) Sudarshan
B.Sc., M.Sc. (Ag.), Ph.D.

Gaur, H.S.
B.Sc. (Hons.), M.Sc., Ph.D.

Gill, J.S.
B.Sc., M.Sc., Ph.D.

Goswami, B.K.
B.Sc., M.Sc., Ph.D.

Haque, M.M.
B.Sc., M.Sc. (Ag.), Ph.D.

Kaushal, K.K.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Khan, E.
B.Sc., Ph.D.

Meher, H.C.
B.Sc. (Hons.), M.Sc., Ph.D.

Misra, S.D.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Majumdar, Vijayalakshmi
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Prasad, D.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Saha, M.
Ph.D.

Singh, R.V.
B.Sc., M.Sc., Ph.D.

Siya, Nand
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Srivastava, A.N.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Plant Physiology

Abbas, (Miss) Sabra
B.Sc., M.Sc., Ph.D.

Abrol, Y.P.
B.Sc., M.Sc., Ph.D.

Anandkumar, P.
Ph.D.

Bagga, A.K.
B.Sc., M.Sc., Ph.D.

Bansal, K.C.
Ph.D.

Bhargava, S.C.
B.Sc. (Hons.) (Ag.), M.Sc. (Ag.), D.Sc.

Chandra, (Mrs.) R.
B.Sc., M.Sc., Ph.D.

Dadlani, (Mrs.) M.
Ph.D.

Deshmukh, P.S.
B.Sc. (Ag.), M.Sc., Ph.D.

Ghildiyal, M.C.
B.Sc., M.Sc., Ph.D.

Lal, R.K.
Ph.D.

Nair Ramachandran, T.V.
B.Sc., M.Sc., Ph.D.

Nanda, (Mrs.) R.
Ph.D.

Ojha, R.J.
B.Sc. (Ag.), M.Sc., Ph.D.

Pandey, M.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Panwar, J.D.S.
Ph.D.

Renu, (Mrs.) Khanna Chopra
B.Sc., M.Sc., Ph.D.

Raghuveer, P.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Ruwali, K.N.
B.Sc., M.Sc., Ph.D.

Sengupta, U.K.
M.Sc. (Ag.), Ph.D.

Sharma, (Mrs.) Aruna
Ph.D.

Shukla, D.S.
B.Sc., M.Sc., Ph.D.

Sinha, S.K.
B.Sc., M.Sc., Ph.D. (1962), Ph.D. (1964)

Srivastava, G.C.
B.Sc., M.Sc. (Ag.), Ph.D.

Uprety, D.C.
B.Sc., M.Sc., Ph.D.

Varier, (Mrs.), A.
B.Sc., M.Sc., Ph.D.

Virendra Nath
B.Sc., M.Sc., Ph.D.

Wasnik, K.G.
B.Sc., M.Sc., Ph.D.

Soil Science & Agril. Chemistry

Ali, S.A.
B.Sc., M.Sc., Ph.D.

Banerjee, N.K.
B.Sc., M.Sc., Ph.D., D.Sc.

Chhonkar, P.K.
B.Sc. (Ag.), M.Sc., Ph.D.

Datta, S.C.
B.Sc. (Ag.) Hons., M.Sc., Ph.D.

Deb, D.L.
B.Sc. (Ag.), M.Sc., Ph.D.

Deo Pal
B.Sc., M.Sc., Ph.D.

Dravid, M.S.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Ghosh (Mrs.) Geetanjali
B.Sc. (Ag.), M.Sc., Ph.D.

Ghosh, S.K.
B.Sc. (Ag.), M.Sc., Ph.D.

Goswami, N.N.
B.Sc. (Ag.) Hons.), Assoc. IARI, Ph.D.

Hassan, R.
B.Sc., M.Sc., M.Phil., Ph.D.

Jain, J.M.L.
B.Sc., M.Sc., Ph.D.

Jain, M.C.
B.Sc., M.Sc., Ph.D.

Krishnakumari, (Mrs.) M.
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Kumar, Sushil
B.Sc. (Hons.), M.Sc., Ph.D.

Kushwaha, J.S.
B.Sc., M.Sc., Ph.D.

Nad, B.K.
B.Sc., M.Sc., Ph.D.

Narayanasamy, G.
B.Sc. (Hons.), M.Sc., Ph.D.

Ram, K.S.
B.Sc., M.Sc., Ph.D.

Rao, Y.S.
B.Sc. (Hons.), M.Sc., Ph.D.

Rattan, R.K.
B.Sc., M.Sc., Ph.D.

Sachdev, M.S.
B.Sc., M.Sc., Ph.D.

Sarkar, M.C.
B.Sc. (Ag.), M.Sc., Ph.D.

Singh, K.D.
B.Sc. (Ag.), M.Sc., Ph.D.

Singh Dhyan
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Singh, Sarjeet
B.Sc. (Ag.), M.Sc. (Ag.), Ph.D.

Shukla, L.M.
B.Sc., M.Sc., Ph.D.

Uppal, K.S.
B.Sc., M.Sc., Ph.D.

Yadav, B.R.
B.Sc., M.Sc., Ph.D.

4 Academic Session and Term Calendar

4.1 The academic year of the Post Graduate School is organised in terms of three trimesters in a year, each approximately of 12 weeks duration.

4.2 The exact dates of each trimester in a particular academic year shall be decided by the Academic Council from time to time. The broad time schedule of the three trimesters is given below :

I trimester	:	September to December
II trimester	:	January to April
III trimester	:	June to September

4.3 There is provision for a summer vacation of approximately seven to eight weeks duration during May and June, or on dates to be specified by the Academic Council. In addition to summer vacation, there is provision for winter break of approximately two weeks and a gap of about one week between 3rd and Ist trimesters on dates to be specified by the Academic Council.

5 Areas of Study : Major Disciplines and Fields of Specialisation

5.1 The main subjects of study and the major areas of activity/specialisation within each main subject in which instruction is offered at the Post-Graduate School, leading to the M.Sc. and Ph.D. degrees, are as follows:

(i) AGRICULTURAL CHEMICALS : Agricultural Chemicals.

(ii) AGRICULTURAL ECONOMICS : Farm Management and Production Economics; Agricultural Marketing and Prices; Agricultural Finance and Cooperation; Agricultural Econometrics; and Agricultural Development and Policy.

(iii) AGRICULTURAL ENGINEERING : Soil and Water Conservation Engineering; Farm Power and Equipment; and Agricultural Processing and Structure.

(iv) AGRICULTURAL EXTENSION : Agricultural Extension; Agricultural Communication and Rural Sociology.

(v) AGRICULTURAL PHYSICS : Agricultural Physics.

(vi) AGRICULTURAL STATISTICS : Sampling Techniques; Design of Experiments; and Genetical Statistics.

(vii) AGRONOMY : Crop Husbandry; and Soil and Water Management.

(viii) BIOCHEMISTRY : Biochemistry; and Nutrition.

(ix) COMPUTER APPLICATION : Computer Application (for M.Sc. only)

(x) ENTOMOLOGY : Insect Taxonomy and Acarology; Insect Toxicology; Insect Physiology; and Insect Pest Management.

(xi) ENVIRONMENTAL SCIENCES : Environmental Sciences.

(xii) GENETICS : Plant Breeding; and Genetics.

(xiii) HORTICULTURE : Pomology; Olericulture; Fruit and Vegetable Preservation; and Floriculture.

(xiv) MICROBIOLOGY : Soil Microbiology; Algology; and Agricultural Bacteriology.

(xv) MOLECULAR BIOLOGY AND BIOTECHNOLOGY : Molecular Biology and Biotechnology.

(xvi) MYCOLOGY AND PLANT PATHOLOGY : Mycology; Plant Pathology; Plant Bacteriology; and Plant Virology.

(xvii) NEMATOLOGY : Nematology.

(xviii) PLANT PHYSIOLOGY : Plant Physiology.

(xix) SEED SCIENCE AND TECHNOLOGY : Seed Genetics, Seed Physiology; Seed Pathology; and Seed Entomology.

(xx) SOIL SCIENCE AND AGRICULTURAL CHEMISTRY : Soil Science; and Agricultural Chemistry.

5.2 In order to strengthen post-graduate research in certain interdisciplinary and crucial areas of work like water technology, a limited number of seats are allocated for admission of students in such field.

5.3 The main subjects and the major fields of specialisation within each main subject in which admissions are to be made in a particular year are subject to review and decided by the Academic Council every year on the basis of availability of facilities in each discipline in terms of faculty members, laboratory, land, etc., and the same will be announced in the 'Information Bulletin' for each year.

6 Admission of Students

6.1 The Institute at present admits students to the P.G. School under five separate streams as indicated below:

- A Open competition
- B Foreign students
- C In-service candidates of Agricultural Universities for promoting faculty upgradation
- D Departmental students
- E I.C.A.R. in-service nominees

The admission policies and procedures have been prescribed by the Academic Council keeping in view the distinct needs and requirements of candidates coming from each stream. The details of these policies and procedures are described in the succeeding paragraphs.

A. OPEN COMPETITION

6.2 System of admission

Admission to the courses shall be made purely on the basis of merit. Selections are made on the basis of performance in the written test; and at an interview. There will be a written test with a weightage of 85 per cent; and rest 15 per cent weightage would be for the interview. The written test shall include to marks out of 85 in knowledgte of general agriculture for M.Sc. and 15 marks out of 85 for Ph.D.

6.3 Advertisement

6.3.1 An advertisement is displayed in the newspapers through the Directorate of Audio-Visual Publicity each year around the third week of May inviting applications for admission. The last date for receipt of applications shall generally be 30th June each year or a date as may be specified from time to time.

6.3.2 The applications from employees of Universities (including institutions deemed as Universities), Central or State Govt. Departments/Undertakings, Statutory Organisations and other Public Institutions, shall be entertained upto the last date prescribed or receipt of Marks sheets (vide para 6.9.7 infra) provided the application is complete in all respects and has been submitted to the applicant's employer before the last date prescribed for receipt of applications, and has been forwarded by such employer officially.

Note : (i) The applications from candidates from Andaman & Nicobar Islands, Laksha Dweep, State/Union Territories in the North-Eastern Region, Ladakh Division of J & K State, Sikkim, Pangi Sub-division of Chamba, Lahaul & Spiti districts of Himachal Pradesh shall be entertained upto the last date prescribed for receipt of marks sheet.

(ii) Only the applications/marksheets, etc., received by post in the first morning dak in the P.G. School Office on the working day immediately following the last date prescribed for receipt of such applications/marksheets will be entertained in relaxation of the prescribed last date as a matter of grace.

6.4 Number of seats

The number of seats earmarked for an academic year for admission to the various disciplines/specialisations, both for M.Sc. and Ph.D., shall be decided each year by the Academic Council. The number of seats shall be published in the Information Bulletin for the concerned year and no change shall be made in the seats once published.

6.5 Reservations for Scheduled Castes/Tribes

6.5.1 Fifteen per cent of the total available seats shall be reserved for Scheduled Castes and seven and a half per cent for Scheduled Tribes candidates subject to their being otherwise suitable. At the time of finalisation of allocation of seats, the seats to be reserved for Scheduled Castes and Scheduled Tribes shall be identified and ear-marked discipline-wise and shall be notified in the advertisement. These reservations shall be interchangeable, i.e. if sufficient number of candidates, are not available to fill up the seats reserved for Scheduled Tribes candidates, these can be filled up from among suitable Scheduled Castes candidates within the discipline. Under no circumstances, the Scheduled Castes and Scheduled Tribes seats shall be transferable from one discipline to another discipline or from M.Sc. to Ph.D. programme and vice-versa. The Schedule Castes/Tribes candidates who are selected for admission on the basis of merit as well as those who are admitted on the basis of relaxed standards may be counted against the reserved quota and there is no maximum limit on the admission of the candidates belonging to the two categories.

6.5.2 If scheduled castes/tribes candidates have been called and have appeared for written test and interview against the quota of seats reserved for them in a particular discipline, these seats shall be kept vacant and not dereserved, even if none of the scheduled castes/ tribes candidates qualify for admission in that discipline.

6.6 Eligibility

6.6.1 The eligibility requirements and other allied matters relating to admission to the P.G. School shall be decided by the Academic Council from time to time. Only those candidates who come from the system of 10 + 2 + 3 or 10 + 2 + 4 or 10 + 1 + 4 (or have a Bachelor's degree under 10 + 2 + 2 system prior to 1985) for the first degree course will be eligible to be considered for admission to M.Sc. programme at I.A.R.I.. The eligibility requirements for admission to M.Sc. and Ph.D. degree programmes for the academic session 1994-95 as approved by the Academic Council are as under. The eligibility requirement are subject to change. Normally these are considered and approved by the Academic Council while finalying the admission policy prior to the begining of each academic session. The detail are given in the Prospectus/Brochure while inviting application for each academic session.

M.Sc. Course : The candidates must satisfy one of the qualifications as indicated against the relevant discipline to which admission is sought.

Ph.D. Courses : The candidates must satisfy one of the qualifications as indicated against the relevant discipline to which admission is sought.

6.6.2 *Qualifications for admission*

(A) *M.Sc. Programme*

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(1) *Agricultural Engineering*

"B.Sc. (Agril. Engineering)/B.Tech./B.E."

(2) *Agronomy*

"Bachelor of Science in Agriculture"

(3) *Horticulture*

"Bachelor of Science in Agriculture OR Bachelor of Science in Horticulture.

(4) *Agricultural Economics and Agricultural Extension.*

"Bachelor of Science in Agriculture OR Bachelor of Science in Dairy Science OR Bachelor of Science in Veterinary Science or Bachelor of Science in Animal Husbandry OR Bachelor of Science in Fisheries".

(5) *Agricultural Chemicals; Agricultural Physics; Agricultural Statistics; Biochemistry; Computer Application; Entomology; Environmental Sciences; Genetics; Microbiology; Molecular Biology & Biotechnology; Mycology & Plant Pathology; Nematology; Plant Physiology, Seed Science & Technology; Soil Science & Agricultural Chemistry.*

"Bachelor of Science in Agriculture OR Bachelor of Science (10+2+3 system) OR Bachelor of Science in Horticulture OR Bachelor of Science in Forestry".

Note : Candidates holding Bachelor of Science under 10+2+2 system prior to 1985 are also eligible to apply of M.Sc. programme.

(B) *Ph.D. Programme*

Discipline	Qualifications
Agril. Chemicals	Master of Science in Agricultural Chemicals OR Soil Science and/or Agricultural Chemistry OR Master of Science in any Branch of Chemistry OR Master of Science in Environmental Science.
Agril. Economics	Master of Science in Agricultural Economics OR Dairy Economics OR any other branch of Economics related to agriculture.
Agril. Engineering	Master's degree in Agricultural Engineering OR Dairy Engineering.
Agril. Extension	Master of Science in Agricultural Extension OR Extension Education OR Dairy Extension OR Fishery Extension.
Agril. Physics	Master's degree in Agricultural Physics OR Master's degree in Soil Science and/or Agricultural Chemistry OR Master Degree in Agricultural Meteorology OR Meteorology OR Physics OR Bio-physics.
Agril. Statistics	Master of Science in Agricultural Statistics OR Statistics OR Mathematical Statistics OR Professional Statistics Certificate Course (PSCC) from IASRI (Formerly IARS).
Agronomy	Master's degree in Agronomy.
Biochemistry	Master's degree in Biochemistry OR Agricultural Chemistry OR Molecular Biology and/or Biotechnology OR Life Sciences OR Master's degree in Chemistry with specialization in Organic Chemistry.
Entomology	Master's degree in Entomology OR Agricultural Entomology OR Zoology.
Environmental Sciences	Master's degree in Science in Environmental Sciences OR any branch of Agricultural Sciences including Agricultural Engineering OR any branch of Biological Sciences OR Physics OR Chemistry.
Genetics	Master of Science in Genetics and/or Plant Breeding OR Molecular Biology and/or Biotechnology OR Horticulture OR Seed Science & Technology OR Microbiology OR Botany OR Agricultural Botany.
Horticulture	Master's degree in Horticulture OR Master's degree in Agriculture with Pomology or Olericulture or Floriculture or Post Harvest Technology as the major field OR Master's degree in Genetics and/or Plant Breeding OR Master's degree in Plant/Crop Physiology.
Microbiology	Master's degree in Microbiology OR Agricultural Microbiology OR Soil Science and/or Agricultural Chemistry OR Genetics OR Botany OR Agricultural Botany OR Molecular Biology and/or Biotechnology OR Biochemistry.

Molecular Biology and Biotechnology	Master's degree in Molecular Biology and/or Biotechnology OR Master's degree in Biochemistry OR Agricutural Biochemistry OR Genetics OR Botany OR Agricultrural botany OR Plant Breeding OR Life Sciences OR Agricultural Microbiology.
Mycology and Plant Pathology	Master's degree in Mycology and/or Plant Pathology OR Botany OR Agricultural Botany OR Molecular Biology and/or Biotechnology OR Genetics OR Microbiology OR Seed Science & Technology OR Biochemistry.
Nematology	Master's degree in Nematology OR Entomology OR Mycology and/or Plant Pathology.
Plant Physiology	Master's degree in Plant Physiology OR Crop Physiology OR Master's degree in Botany OR Agricultural Botany OR Biochemistry OR Master's degree in Life Sciences OR Master's degree in Molecular Biology and/or Biotechnology.
Seed Science and Technology	Master's degree in Seed Science & Technology OR Genetics OR OR Plant Physiology OR Crop Physiology OR Mycology and/or Plant Pathology OR Entomology OR Nematology OR Botany OR Agricultural Botany.
Soil Science and Agricultural Chemistry	Master's degree in Soil Science and/or Agricultural Chemistry OR Master's degree in Chemistry.

6.6.3 A good knowledge of English is essential. All non-agricultural graduates will have to complete prescribed course in Introductory Agriculture of 24 credits before they are permitted to take regular courses and to qualify for the degree. The candidates, who do not possess B.Sc. (Agriculture), B.Sc. (Horticulture) or B.Sc./B.Tech. in Agricultural Engineering shall have to successfully complete the prescribed courses on Introductiory Agriculture of 24 credits in the first year of the three year programme of M.Sc. for these students. The candidates, who have not been exposed to subjects of Agriculture in their Bachelor's or Master's degree programme shall have to take prescribed courses on Introductory Agriculture of 24 credits in the first year of Ph.D. programme.

6.7 Recognition of degrees of other universities

Degrees of all statutory universities and institutions deemed to be Universities shall be recognised by the Institute for purpose of admission to higher courses of study at this Institute on a reciprocal basis.

6.8 Age limit

The minimum age limit for admission to M.Sc. and Ph.D. shall be 19 and 21 years respectively. The age shall be reckoned as on 31st December of the year of admission and no further relaxation will be given to the candidates.

6.9 Procedure for application

6.9.1 Applications for admission shall be made in the prescribed form obtainable from the Registrar (Academic), Post Graduate School, Indian Agricultural Research Institute, New Delhi 110 012. The application form and the 'Information Bulletin', can be had on payment of Rs. 50.00 in person or by sending a crossed Demand Draft for Rs. 50.00 and drawn in favour of the Registrar (Academic), Post Graduate School, Indian Agricultural Research Institute, New Delhi 110 012 alongwith a self addressed and duly stamped envelope (Rs. 5/-) alongwith his/her request. Demand Draft in favour of any officer other than the Registrar (Academic), Post Graduate School, shall not be accepted. If the request does not bear the full and legible address of the candidate, the Post Graduate School shall not take any responsibility of sending forms, etc. Local candidates may pay Rs. 50.00 at the Post Graduate School cash counter and on production of the money receipt may obtain the form, etc., in person. The charges mentioned above are subject to review and change from time to time.

6.9.2 Each application form shall bear a serial number. This number as also the course and the main subject to which the admission is sought must be quoted in all correspondence regarding admission to this school. A candidate can apply for admission to one subject (discipline) only.

6.9.3 All correspondence for admission should be addressed to the Registrar (Academic), Post Graduate School, Indian Agricultural Research Institute, New Delhi 110 012.

6.9.4 Candidates who are in employment must submit their applications through proper channel. No advance copies shall be considered.

6.9.5 Sponsorship : An employee is considered as a sponsored candidate, if he/she is sponsored for admission at this Institute under the terms of deputation leave, or study leave, or extraordinary leave or under grant of a scholarship/stipend/any other financial assistance and is bound under the terms of the sponsorship to return to the sponsoring Institution after the training. An employee permitted by the employer to pursue post-graduate studies at this school at his/her own expenses on the understanding that he/she, is admitted, would have to resign the employment shall not be treated as sponsored candidate.

6.9.6 All applications as also the acknowledgement cards (duly stamped) filled in legibly and correctly in applicant's own handwriting should be forwarded, with the accompanying set of documents completed in all respects so as to reach the Registrar (Academic), Post Graduate School, Indian Agricultural Research Institute, New Delhi 110 012 on or before the last date notified. Postal delay shall not be accepted as a plea to entertain applications after the last date.

6.9.7 In case a candidate has appeared for the degree examination and the result had not been announced in time for submission of the application by the last date prescribed, the application may still be completed in all respects, except the academic record, and submitted so as to reach the Registrar (Academic) by the due date. Information with regard to the academic record shall then be furnished as soon as it becomes available in duplicate. However, this information must reach the Registrar (Academic) by the 14th July or a date to be notified each year. Postal delay cannot be accepted as a plea to entertain this information beyond this date.

Note: Only the application/marks-sheets etc., received by post in the first morning dak in the P.G. School Office on the working day immediately following the last date prescribed for receipt of such applications/marksheets will be entertained in relaxation of the prescribed last date, as a matter of grace.

6.9.8 In the case of a candidate coming from an University following the course-credit system, the application shall be considered even though the final viva-voce is yet to be completed, provided a full transcript is enclosed showing the grade point average obtained alongwith a Course Completion Certificate from the Registrar of the University/Head of the College, Dean/Associate Dean of the campus of multi-campus Universities to the effect that the candidate had completed all the prescribed course work. The certificate issued in this regard by the Heads of Department shall not be entertained. However, at the time of interview a certificate shall have to be produced from the Registrar of the University/Head of the College, Dean/Associate Dean of the campus of multi-campus Universities stating clearly that the candidate has passed the last degree examination, failing which the candidate shall not be interviewed.

6.9.9 Notwithstanding anything contained in para 6.9.8 supra, a candidate, who is doing M.Sc. at the IARI at the time of making application for admission to Ph.D. may be permitted to appear in the written test and interview pending the holding of his Final Viva-Voce Examination, if he/she has already completed all course work and submitted his/her thesis. Such a candidate, if included in the regular Merit List/Waiting List, may be granted admission to Ph.D. during the validity of these lists with the approval of the Chairman of the Academic Council, where the Final Viva-Voce Examination is held after the commencement of the new academic session and student is thereupon declared to have become eligible for the award of M.Sc. degree, provided:

(i) the student had submitted his/her thesis by the date specifically prescribed for the purpose, and

(ii) the delay in the holding of the Final Viva-Voce Examination is not attributable in any way to the candidate concerned.

6.9.10 The candidate must in his/her own interest fill up the application form most carefully and accurately and ensure that all certificates required to be attached are enclosed. All enclosures must be page-numbered. Incomplete application shall not be considered and may rejected outright.

6.9.11 Attested copies of the following certificates and documents shall be enclosed:

(a) Proof of date of birth.

(b) Matriculation or equivalent certificate and marks sheet

(c) Pre-University examination certificate and marks sheet, if applicable

(d) Higher Secondary examination certificate marks sheet, if applicable

(e) Intermediate examination certificate and marks sheet, if applicable

(f) Bachelor's degree certificate and marks sheet

(g) Master's degree certificate and marks sheet (in the case of application for Ph.D.)

(h) Course Completion Certificate is required in the case of candidates coming from a university following the course-credit system. This certificate from the Registrar of University/Principal of the College, Dean/Associate Dean should certify to the effect that the candidate had completed all the prescribed course work. (Certificate from officials otherthan those four mentioned above shall not be entertained)

(i) Scheduled Caste/Tribe certificate in the proforma as at annexure from District Magistrate or the authorities empowered to issue such certificate of verification issued not more than six months before the date of application

(j) Documentary evidence of continuous employment from employer(s)

(k) Certificate (in original) of physical fitness issued not more than six months before the date of application by a Registered Medical Practitioner

(l) One character certificate issued by Principal/Head of the Department/Dean/Registrar of the College/Institute last attended (not required case of candidates in government service)

(m) One recent passport size photograph to be affixed in the space provided at page 1 of the application form and two others on Admit Cards

(n) Candidates who have played in State or National level tournament should furnish an attested copy of the certificate in support thereof

Production of original certificates and marks-sheets at the time of interview and enrolment is an essential requirement which is not relaxable in any case under any circumstances. If any document submitted by the candidate is found to be false at any stage during his/her study at IARI, his/her admission will be cancelled.

6.10 Scrutiny of applications

6.10.1 The application shall be indexed separately for M.Sc. and Ph.D. and entered alphabetically in a register the day they are received.

6.10.2 All the applications received shall be screened by the P.G. School office. After checking all the factual data furnished by the candidate, the P.G. School shall complete the data processing sheet.

6.10.3 The applications shall then be forwarded to the Professor of the concerned discipline for screening and determining the eligibility of the candidates and the applications shall be returned by the Professor to the P.G. School within the stipulated time after indicating 'found eligible' or "not found eligible" on each application. The legibility of applicants should be judged strictly on the basis of the terms and conditions of the advertisement.

6.10.4 The applications of candidates who do not fulfil the minimum eligibility requirements prescribed shall be rejected.

6.11 Eligibility for the written test

6.11.1 Candidates to be called for the written test shall have a minimum qualification prescribed for the purpose.

6.11.2 There will be one written paper with a total weightage of 85 per cent for the subject paper; and the rest 15 per cent weightage would be for the interview.

6.11.3 The minimum qualifying marks in the written test shall be fifty (50) per cent in respect of candidates otherthan SC/ST for whom it will be forty-five (45) per cent. This condition shall not be applicable to foreign students.

6.11.4 Candidates selected for written test based on the academic requirement will be informed of the date, time and venue of written test through a letter under certificate of posting duly signed by and bearing the official stamp of the Registrar (Academic) of the Post Graduate School of this Institute.

6.11.5 In case there is any change in the date of examination for some unforeseen reasons, the final date will be indicated in the written test call letter.

6.11.6 Candidates who are called for the written test will have to come at their own expenses and will have to make their own stay arrangements. However, the SC/ST candidates (except employed candidates) called for written test will be paid to and fro second class rail fare, subject to production of caste certificate issued by the competent authority on the proper proforma and evidence of journey performed.

6.11.7 *Interview of candidates* : (a) A discipline-wise merit list shall be prepared based on the performance of the candidate in the written test. For Scheduled Castes/Scheduled Tribes, the merit list shall be prepared separately for each discipline. Candidates in order of merit in the written test in each discipline shall be called for interview in ratio limited to 1 : 4.

(b) The candidate called for interview shall have to appear before a duly constituted Interview Board for each discipline. The interview will be held at IARI, New Delhi or any other place decided by the Academic Council. Each candidate shall be interviewed separately. General candidates shall be interviewed first. The SC/ST candidates interviewed subsequently but separately and their performance should be judged independently without comparing them with the general candidates.

(c) No candidate shall be interviewed unless the original certificates, marks-sheets, etc. are produced before the Secretary of the Interview Board of each discipline before the actual interview. However, in cases where the original marks-sheet indicates clearly that the candidate has passed the concerned examination, the candidate can be interviewed even if the original degree certificate has not been produced. In case a candidate has already submitted an attested copy of marks-sheet of the qualifying examination issued by the Registrar of the University concerned but is unable to produce the original at the interview mark sheet had been submitted to another university, he/she may be allowed to appear in the interview but it should be made clear to candidate that, if selected, his/her admission would be subject to production of original certificate by him/her. No other relaxation can be given by the Interview Board. There can be no appeal to any authority, if the candidate fails to produce the original documents prescribed except to the extent indicated herein above.

The Interview Board shall consist of the Director; the Dean & Joint Director (Education); the concerned Head(s) of the Division(s); the concerned Professor; and 3 faculty members including two from outside the concerned discipline. The Dean & Jt. Director (Education) with the approval of the Director, IARI shall nominate the other members of the Board.

6.11.8 Invitation to the written test—interview is by itself no guarantee of admission to the Post Graduate School.

6.11.9 The Dean will decide the manner of conducting the written tests and interview including all the relevant details.

6.11.10 The written test papers will be evaluated in the manner decided by the Dean. The score of the written test will be determined according to the weightage assigned to the written test.

6.11.11 The marks in the written test of the candidates shall be kept confidential in the P.G. School office. The written test marks and interview marks shall be totalled in the P.G. School. On the basis of the total marks obtained by each candidate, a list of the candidates in descending order of merit shall be prepared in respect of all the candidates called for interview. The SC/ST candidates will be shown as a distinct category and their merit shall also be shown separately.

6.12 Announcement of results

6.12.1 The marks obtained by the candidates in the final selection shall be worked out upto the first decimal place, the decimal fractions of .05 or above occurring at the second decimal place being rounded off upwards and those of .04 or below being ignored. In the case of tie, admission will be given to the candidate whose written test marks are the highest. If there is a tie in this respect also, the marks obtained by them may be reduced to the second or third digit and the admission given to the student who obtained higher marks.

6.12.2 The minimum percentage of marks for qualifying in the written test for admission shall be fifty (50%) in respect of general candidates and forty five (45%) for SC/ST candidates.

6.12.3 The final list of candidates to be admitted to the P.G. School on the basis of the seats allotted to each discipline shall be approved by the Academic Council and the results will be notified thereafter. The notification shall be displayed on the Notice Boards of the IARI Library, P.G. School and P.G. Hostels, and the individual candidates would be informed of their result by post.

6.12.4 The notification announcing the names of the selected candidates for each discipline shall consist of two parts, viz. (a) regular list and (b) waiting list. The seats will first be offered to the qualified candidates in the order of merit upto the number of seats available in each discipline. The names of the remaining qualified candidates in the merit list shall be kept in the waiting list in the order of merit.

6.12.5 The seats reserved for SC/ST candidates shall be offered to only SC/ST candidates in the order of merit.

6.12.6 If SC/ST candidates secure a seat on their own merit in competition with general candidates, they shall not be counted against the reserved quota.

6.12.7 The selected candidates will have to pay the prescribed fees and join the P.G. School by the due date notified.

6.12.8 The Dean may, however, in exceptional cases and in consultation with the Professor concerned, grant extension of the date of joining or permit the selected candidates to join in the II trimester, subject to the condition that this shall not involve corresponding extension of the maximum time limit or completion of studies.

6.12.9 If the candidate does not join the P.G. School by the prescribed date or if no extension has been asked for and granted, the admission shall stand cancelled automatically and the seat shall be offered to the candidate in the waiting list in order of merit. This shall apply to all selected candidates including nominees of State Departments of Agriculture, Universities and other Institutions as also departmental students.

6.12.10 If any new admitted leaves the P.G. School/discontinues his/her studies within the validity period of the Waiting List, the seat shall be offered to the candidate in the Waiting List in order of merit. The candidate n the waiting list has to join the P.G. School and pay the requisite fees within seven days of the issue of the communication regarding his/her admission.

6.12.11 The number of seats already allocated by the Academic Council to each discipline shall in no case be increased to accommodate the candidates in the waiting list.

6.12.12 The validity of the select list and waiting list shall cease on 30th of September of the year of admission.

6.13 Requirements for new students

6.13.1 On production of the communication intimating admission, the students shall be asked to appear for medical examination before the Medical Officer of the Institute.

6.13.2 On receipt of satisfactory medical report and production of original certificates to the P.G. School for verification and on payment of the prescribed fees an enrolment card addressed to the Professor concerned shall be given to the candidate indicating his/her roll number. On production of the enrolment card he/she will be allowed to mark attendance in the discipline, utilise library facilities and secure hostel accommodation.

6.13.3 In order to make all fresh students fully conversant with the requirements and working of the course credit system, an orientation programme shall be arranged immediately after the admission at which attendance shall be compulsory.

B. FOREIGN STUDENTS

6.14 System of admission

6.14.1 Foreign students seeking admission shall forward their applications through their respective Embassies at New Delhi or through the respective Indian Missions abroad to the Government of India/ICAR and their candidature shall be considered only if they are sponsored by the Government of India/ICAR.

6.15 Eligibility

6.15.1 Foreign students are exempted from appearing in the written test and interview. Thus admission shall be made on the scrutiny of the bio-data and on the recommendation of the Professor of the concerned discipline.

6.16 Procedure for application

6.16.1 The last date for receipt of applications and results/marks-sheets from the applicants who are foreign nationals but are resident in India will be the same as prescribed for the applicants who are Indian citizens, and that the self-financing foreign students out of them will be called for the written test and interview only if they have prescribed qualifications as for the Indian applicants for admission through the open competition stream.

6.16.2 The applications of foreign students shall be forwarded to the Professor of the concerned discipline for determining their eligibility and their admission shall be finalised without any written test. Foreign students who are already resident in India will, however, have to appear in the written test and interview. Besides, candidates mentioned in para 6.14.1, those sponsored by International Organisations like the Agricultural Development Corporation, FAO, etc., shall also be considered for admission at IARI provided such requests are received through the ICAR/DARE. Their cases shall also be considered alongwith other regular students without giving them any concession in minimum marks but they shall be exempted from appearing in the written test and interview.

6.16.3 Foreign students should arrive in New Delhi one week before the opening of the academic session to acquaint themselves with the operation of the Post Graduate School and with the city of Delhi and to attend the orientation programme. They should contact the Foreign Student's Adviser upon their arrival for obtaining guidance concerning registration procedure, campus location and all other matters except those of a strictly academic nature.

C. IN-SERVICE CANDIDATES OF AGRICULTURAL UNIVERSITIES FOR PROMOTING FACULTY UPGRADATION

6.17—System of admission

6.17.1 The Academic Council has approved a new stream of admission with effect from the academic year 1974–75 for admission of in service candidates from agricultural universities as part of the faculty upgradation programme. Separate guidelines have been prescribed for this stream of admission.

6.17.2 The scheme shall cover only faculty members of agricultural universities and is applicable for admission to Ph.D. programme only.

6.17.3 The quota of seats to be reserved for such category shall not exceed 20 in a particular year. This quota shall be reviewed/revised annually by the Academic Council in the light of the experience gained in a particular year. The quota shall be over and above the quota generally fixed by the Institute in respect of other categories.

6.17.4 15% seats will be reserved for Scheduled Caste and $7^1/_2$ for Scheduled Tribe candidates.

6.18 Eligibility

6.18.1 The candidate should have good Master's degree in agriculture in the concerned discipline or should satisfy one of the qualifications as specified in para 6.6.2.

6.18.2 The time schedule of admission under this programme shall be suitably advanced. A circular shall be sent to all the agricultural universities in January each year inviting applications for admission.

6.18.3 The candidates sponsored under this scheme should be regular employees of the University and likely to continue in service after obtaining the training. The candidates should normally be sponsored on deputation terms entitling them for full salary and allowances, and no fellowship will be awarded to them by the IARI. Those sponsored on study leave or equivalent terms will also be considered for admission under this scheme. A certificate to this effect should be given at the time of forwarding the application. The University sponsoring the student under the scheme should also certify that the candidate had not been administered any warning or awarded other penalties for any kind of mis-conduct. The enrolment card for these candidates shall be issued only if the deputation orders providing for the above facilities are submitted to the P.G. School.

6.18.4 The Sponsoring Universities should indicate in the form of application for admission itself as to whether they would have or not have any objection to their sponsored candidate holding an office in the P.G.S.S.U.

6.18.5 Candidates shall be officially sponsored under the scheme and the application shall be sent by the concerned agricultural university. The words, "Sponsored for admission under Faculty Upgradation Scheme", shall be clearly inscribed on the application form and the forwarding letter. "Not more than three candidates sponsored by any one University shall be admitted in any one year under this scheme".

6.18.6 The candidates shall appear in the written test of the discipline concerned for determining their eligibility The final selection of the candidates shall be done by a Core Selection Committee approved by the Academic Council. The Academic Council of the IARI shall have the full discretion of allotting the seats to the universities after taking into account their special needs.

6.18.7 Candidates selected for admission under this scheme shall report to the P.G. School for enrolment at the commencement of the academic year.

6.18.8 All the regulations contained in the P.G. School Calendar shall be applicable to this category of students also subject to the special provisions mentioned in paras 6.17.1 to 6.18.8.

6.19 Admission of in-service candidates from the agricultural universities for doing course work only at I.A.R.I. for their Ph.D.

6.19.1 Facilities for doing course work only for Ph.D. degree may be provided to staff members sponsored by the Agricultural Universities, subject to the conditions that the sponsoring University should certify that they do not have the requisite facilities for doctoral level teaching in the respective disciplines and the University concerned intends to strengthen its faculty in the respective area with a view to improving teaching/research programmes therein. No fellowship shall be awarded to the candidates by IARI.

6.19.2 The studentship of the candidates of this category shall be regulated by the following further terms and conditions:

(i) The candidates will not be formally enrolled as IARI students and will be treated as trainees only.

(ii) The PPW of the candidates shall be finalised by the respective Chairman at the University concerned in consultation with the concerned Professor at IARI.

(iii) The candidates will be attached to the concerned Professors at IARI for advisement in respect of their course work. There will be no Co-Chairman at IARI.

(iv) The candidate shall take only the specialised and advanced courses at this Institute for which facilities are not available in his/her parent University.

(v) The transcript to be given by the University should acknowledge the courses attended by the student at IARI. This should also be acknowledged in his/her thesis.

(vi) The concerned Professor or any other faculty member nominated by the Board of Studies of IARI shall be co-opted as a member in the qualifying examination of the candidate. TA/DA of the Professor or of the other Faculty member nominated by the Board of Studies for any journeys performed or the purpose shall be payable by the sponsoring University.

(vii) The sponsoring University/Deptt. will remit the salary/deputation allowance, etc., directly to the candidates.

(viii) The IARI shall not be under any obligation to provide hostel accommodation. No family accommodation will be provided in any circumstances.

(ix) The candidates will themselves be responsible for making payment of tuition fee and other dues in the prescribed manner with the syndicate Bank, Pusa Branch by the prescribed dates.

(x) The candidates admitted for course work only at IARI shall not be eligible to apply for admission as regular candidates for Ph.D. programme in any stream at IARI.

D. DEPARTMENTAL STUDENTS

A limit number of eligible staff members shall be admitted as departmental students to the regular Post Graduate programmes of the Institute. The rules (effective from 1980–81 session onwards) governing such admissions are indicated below.

6.20 Scientific staff

6.20.1 Only the Scientists, up to and including Scientist/Scientist (Sci) or equivalent position who are having an M.Sc. degree and have satisfactorily completed period of probation and rendered not less than 5 years regular continuous service including period of probation at IARI including its Regional Research Station as on 31st March of the year of submission of application, shall be eligible to be considered for admission to the Ph.D. course in the disciplines relating to their M.Sc. degree at IARI as departmental candidates provided they have already been granted, or have been assured the grant of study leave for a period of 2 years. The Scientists who leave the Institute after serving for 3 years without retaining their lien will not be allowed the benefit of their service for admission purposes when they join the Institute again.

6.20.2 A candidate of the IARI having less than 5 years' service as prescribed in the IARI but who has rendered more than 5 years' qualifying service including the service rendered by him/her in the IASRI, may not be considered for admission to a Ph.D. programme as a departmental candidate except for Agricultural Statistics.

6.20.3 For the purpose of admission to a discipline other than Agricultural Statistics, only the service rendered in a qualifying post in the IARI shall be taken into consideration.

6.20.4 For determining eligibility for admission to the discipline of Agricultural Statistics as a departmental candidate, the service rendered in IASRI alone shall be taken into account.

6.21 Technical staff

6.21.1 Staff holding posts upto the scale of 1100–1600 (pre-revised) who are science graduates and have satisfactorily completed period of probation and rendered not less than 5 years regular continuous service including period of probation shall be eligible to apply for admission to the M.Sc. programme in the discipline in which they have been working at the IARI as Departmental Candidate.

6.21.2 Technical Staff holding posts upto the scale of Rs. 1100–1600 (pre-revised) who are having an M.Sc. degree and have satisfactorily completed period of probation and rendered not less than 5 years regular continuous service including period of probation shall be eligible for admission to Ph.D. programme in the discipline relating to their M.Sc. degree, as Departmental Candidate.

6.21.3 Seats reserved for technical staff shall be restricted to one seat per discipline only but the seat will be inter-transferable subject to a maximum of two seats per discipline in case of non-availability of candidates in that particular discipline.

6.21.4 Scientific/Technical personnel, who is registered for a higher degree with an outside university will also be eligible. In case such an employee is selected for admission as a departmental candidate, an intimation to this effect will be sent by the P.G. School to the outside University requesting for cancellation of his/her registration with that University. A suitable column for this information will be incorporated in the application for departmental candidates.

6.21.5 An employee of the categories indicated above shall be given the facility of admission as departmental student once, either for obtaining the M.Sc. or Ph.D. degree, to ensure that a maximum number of employees get this facility.

6.22 Procedure for fixing the quota of seats

6.22.1 The number of departmental candidates at any time in any discipline shall not exceed 20 per cent of the strength of the eligible staff of the discipline (as per admission standard prescribed), subject to a minimum of 2 seats per discipline at any one time. The eligible staff in the Regional Research Stations shall be treated as part of the discipline to which they belong.

6.22.2 15% seats will be reserved for Scheduled Caste and 7 1/2% for Scheduled Tribe candidates.

6.22.3 The allocation of seats for purposes of admission of departmental students shall be discipline-wise with respect to the disciplines approved for teaching. Currently, this will be with respect to the 20 disciplines approved for teaching. The eligible scientists should be categorised and listed according to the teaching disciplines and the quota of seats calculated accordingly. Every eligible scientist shall be informed about the parent discipline to which he will belong based on academic qualifications and job requirements. He will be given an opportunity to express his views about the discipline-wise categorisation and the final decision about his field of discipline will be taken after considering his views, if any.

6.22.4 Whenever a new teaching discipline is set up and if an employee who is also a student is transferred, he/she shall be shown against the quota of seats of the new discipline.

6.22.5 The list of eligible employees shall include only those, who have put in 3 years' service at IARI including the Regional Research Stations as on 31st March of the year of submission of application and possess the minimum educational qualifications prescribed and indicated in para 6.23.1 below. Those employees who have availed or are currently availing of the facility as departmental students shall not be included in the list.

6.22.6 A seat shall be deemed to have been vacated for the purpose of admitting a fresh departmental candidate as soon as the student has successfully completed his/her qualifying examination. The qualifying examination of such of the departmental candidates as are due to vacate their seats in a particular academic year should be held by the 31st March of that year. This should be strictly adhered to and individual requests for relaxation should not be entertained under any circumstances.

6.23 Eligiblity standards for application

6.23.1 A Bachelor's degree for admission to M.Sc. and a Master's degree for admission to Ph.D. is essential. The candidate should satisfy one of the qualifications as specified in para 6.6.2.

6.23.2 Weightage shall be given to the scientific/technical staff at IARI/IASRI at the rate of 2 marks for each completed year of service for the first five years and one mark for each subsequent completed year of service, limited to a maximum of 15 marks. Additional weightage of 5 marks shall be given to the employees posted at Regional Research Stations provided they have 2 years service at the Regional Research Station on the last date of submission of application form.

6.24 Procedure for submission of application, written test and selection

6.24.1 The last date for receipt of applications from the employees shall normally be the last date prescribed for receipt of applications for admission under the Faculty Upgradation Scheme.

6.24.2 The application of a departmental candidate shall be routed through the Joint Director (Admn.) so that the questions of grant of study leave to the applicant and the feasibility of alternative arrangements being made are clearly decided before forwardal of the application for admission.

6.24.3 (i) A staff member shall be eligible to apply for only one subject pertaining to the parent discipline to which he/she is allocated.

(ii) At the time of submitting the application for admission the staff member should give full information about his/her establishment, his/her specialisation, his/her area of work, etc.

6.24.4 (i) All those employees who fulfil the qualifications prescribed shall be eligible to be called for the written test for admission.

(ii) The minimum qualifying marks for admission in respect of general candidates, faculty upgradation scheme, ICAR nominees scheme and under departmental quota would be 50 and that for SC/ST candidates in any stream would be 45, in both cases out of 100 maximum marks.

6.24.5 The departmental candidates seeking admission as departmental students shall be treated as a separate category. However, they will appear in the written test and interview with all other categories of candidates.

6.24.6 The Interview Board constituted for selecting full time students will also interview the staff members seeking admission under this stream.

6.24.7 The admission of any staff member as departmental student shall automatically stand cancelled if he/she fails to join the course on the due date.

6.24.8 A staff member not selected in a particular year shall not be debarred from consideration for admission in the next academic year in case of vacancy is available in the concerned discipline.

6.24.9 If a departmental student is transferred or promoted during his/her studentship to another post, the Post Graduate School should be notified. A No Objection Certificate should also be obtained from his/her immediate supervisory officer in his/her new post to the effect that he has no objection to the candidate working with his previous major adviser and on a research problem chosen by him/her prior to his/her transfer/promotion. This should apply even to candidates registered with outside Universities.

E. ICAR IN-SERVICE NOMINEES

6.25 System of admission

6.25.1 The Academic Council has approved a separate stream of admission to Ph.D. degree programme with effect from the academic session 1979–80 for in-service candidates of the Indian Council of Agricultural Research (ICAR). The number of seats reserved for the ICAR in-service candidates shall not exceed 5 in a particular year, but the number of students under this stream shall not exceed 15 at any time. Only such ICAR employees who are awarded ICAR Senior Fellowship shall be eligible to apply under this stream.

6.25.2 15% seats will be reserved for Scheduled Caste and 7 1/2% for Scheduled Tribe candidates.

6.25.3 The procedure prescribed for admission of candidates under the Faculty Upgradation Scheme will apply mutatis-mutandis to this scheme.

6.25.4 Candidates sponsored by the ICAR will appear in the written test and interview. A single merit list will be prepared for candidates under quota of this stream.

6.26 Registration of students in each trimester

6.26.1 Every student enrolled shall be required to register at the beginning of each trimester, on a date pre-determined, till the completion of his/her degree requirements, unless otherwise permitted by the Dean, failing which his/her enrolment shall be cancelled. Re-admission in such cases shall be on application and not as a matter of right.

Registration shall consist of the following steps :

(a) Filling up the roster forms for courses to be offered in that trimester. (Annexure IV).

(b) Submission of progress report for the preceding trimester. (Annexure V).

(c) Payment of the fees and other dues to the Post Graduate School in time.

(d) Depositing with the P.G. School the prescribed registration forms duly filled in and signed by the major adviser/Professor. (Annexure VI).

6.26.2 Registration for the first trimester of the year for fresh students is a part of the admission procedure and shall be governed by the admission rules. Registration in respect of continuing students in each trimester shall however be completed on the first day of each trimester and the classes shall commence thereafter.

6.26.3 The registration of continuing students shall not be permitted later than 7 days from the date of commencement of the trimester unless allowed by the Dean as a special case. If during the registration days, a student is required to be outside the Institute campus on the basis of prior permission, in connection with the duties, field work, research work or due to other unavoidable and legitimate circumstances, he/she may be permitted by the Dean to register himself/herself by submitting by post the necessary registration forms and fees.

6.26.4 A continuing student who does not register on the notified date shall be required to pay a late fee of Rs. 10/- for the first day of lapse and at the rate of Rs. 2/- for each subsequent day till the registration is completed.

6.26.5 A student may be exempted from the payment of late registration fee by the Dean where he is convinced that the student is late due to circumstances beyond his control.

7 Fees and Other Charges

7.1 The following charges shall be payable by a full time student (both M.Sc. and Ph.D.) admitted to the P.G. School :

		Rupees
(i)	Caution money (refundable) payable once on admission	200.00
(ii)	Registration fee payable on admission	5.00
(iii)	Tuition fee payable on or before the date of registration for each trimester :	
	I Trimester	100.00
	II Trimester	75.00
	III Trimester	75.00
(iv)	Hostel, water & electricity charges payable alongwith the tuition fee for each trimester (not required of students exempted from taking residence in the hostel) :	
	I Trimester	68.00
	II Trimester	51.00
	III Trimester	51.00
(v)	Consolidated charges for hostel room, and water & electricity, payable for vacation months (by those residing in hostels during this period)	34.00
(vi)	a. Charges for allottees of married students' apartments, payable by 10th of every month (For less than fortnight)	75.00 (40.00)
	b. Charges for the New Married Students Apartments (Rs. 10/- for water charges and actual consumption of electricity charges as extra)	85.00

(vii)	P.G. School Students' Union fee payable alongwith the tuition fee for the I trimester, each academic year	25.00
(viii)	P.G. School Students' Union magazine fee, payable alongwith tuition fee for the I trimester, each academic year	10.00
(ix)	P.G. School journal fee, payable alongwith the tuition fee for the I trimester, each academic year	20.00
(x)	P.G. School Students' Welfare Fund, payable alongwith tuition fee for the I trimester, each academic year	10.00
(xi)	P.G. School Students' Sports Fund payable alongwith tuition fee for the I trimester, each academic year	25.00
(xii)	Post Graduate School Student's Cultural Activities Fee	25.00
(xiii)	Post Graduate School Student's Literary Activities Fee	25.00
(xiv)	Examination fee, payable once with the tuition fee for the III trimester of the first academic year	
	— for Ph.D.	100.00
	— for M.Sc.	60.00
(xv)	Identity Card	1.00

7.2 All departmental candidates on rolls from the commencement of 1987–88 academic session shall be required to pay all fees as applicable in the case of general candidates.

7.3 Students belonging to the scheduled castes/tribes community are entitled to reimbursement of fees mentioned at items (iii) and (vii) to (xiv) in para 7.1 above.

7.4 The tuition fee shall include the charges for accommodation in the hostel, irrespective of whether a student is residing in hostel or not.

7.5 Fees and the hostel water and electricity charges shall be payable before the student is permitted to register at the beginning of each trimester. Failure to pay the fees and other prescribed charges shall result in the cancellation of the registration of the student and such cases will be governed as per the provision in para 6.10.1.

7.6 The P.G. School shall reserve the right to recover the dues from the fellowship amount or any other amount payable to the students.

7.7 Unless specially permitted by the Dean, the name of the defaulter shall stand struck off from the rolls if the registration is not made within one month of the date of commencement of the respective trimester. In the case of a student whose name is struck off from the rolls, the Master of Halls of Residences shall confirm within a week that the room in the hostel has been vacated by the student and the Professor of the discipline concerned shall confirm within a week that the student is not being allowed to attend the classes/laboratory in the Division. He/she may, however, be re-admitted at the discretion of the Dean on the submission of an application through the Chairman of the Advisory Committee and the Professor and on payment of re-admission fee of Rs. 10/- as also the fine.

7.8 The period during which a student's name remains struck off the rolls shall not be counted towards his minimum residential requirement at the School nor will attendance in class during that period be counted.

7.9 Students discontinuing their studies on and from any date following the commencement of a trimester shall be liable to pay the full tuition fee for that trimester.

7.10 Tuition fees once paid are not refundable. Exemption from this clause shall, however, be granted by the Dean on the merits of each case. Registration fees once paid shall never be refunded.

7.11 The caution money is repayable on completion of course of studies after deducting dues, if any.

7.12 Where a student fails in the qualifying examination or the final viva voce examination or is required to resubmit the thesis, the student will be required to pay the prescribed examination fee again for each such re-examination.

7.13 Other charges

The following charges shall be leviable for issuing various certificates etc.

		Amount (Rs)
(i)	Provisional Degree Certificate	5.00
(ii)	Transcript*	10.00
(iii)	Certificate of age as recorded in the P.G. School Register	5.00
(iv)	Duplicate of degree and other certificates	20.00
(v)	Award of degree *in absentia*	25.00
(vi)	Bona fide certificate	No charge
(vii)	Character certificate	No charge
(viii)	Any other certificate	5.00

*The P.G. School will issue a transcript free of charge on completion of the entire course work included in the PPW and at the time of the award of the degree at the Convocation.

8 Medals and Awards

A. MEDALS

IARI Merit Medals shall be awarded to meritorious 3 M.Sc. and 5 Ph.D. students on the basis of following criteria and procedure:

8.1 Award of IARI Merit Medals to M.Sc. students

8.11 *Eligibility*

(a) He/she should have completed a minimum of 45 credits (55 credits for Ag. Stat. students) in major, minor and other supporting fields excluding Remedial courses/ Introductory Agriculture and AIS.

(b) Completed all the prescribed course-load requirements within the maximum period of 6 trimesters.

(c) Obtained a minimum OGPA of 3.75 out of four. Those who obtain 'F' or 'I' grade in any course or repeat a course are not eligible for award of Merit Medals.

(d) Obtained a minimum of 70 out of 100 marks at the common written qualifying Examination.

(e) The students taking 'make-up examination' will not be eligible for award of the Merit Medals.

(f) Should not have been awarded disciplinary punishment during studentship at the IARI.

8.1.2 *Criteria for assessment of comparative merit*

(a) The weightage given to the different aspects for consideration of the award of IARI Merit Medal is given below:

(i) OGPA 50%
(ii) Written qualifying examination 25%
(iii) Thesis presentation (before the Common Evaluation Committee) 25%

(b) In case there is a tie between two candidates, the one having earned the GPA with larger number of credits in the discipline and if there is a tie in this respect also, the one having completed the larger course work (i.e. total course load including minors) shall receive the award.

(c) The OGPA of 4.00 out of 4.00 will be treated as equivalent to 200 marks for the purpose of award of IARI Merit Medals.

(d) The grades earned in respect of the credits added after the first two trimesters after enrolment shall not be counted for the purpose of award of IARI Merit Medals.

(e) Candidates dropping any course from the PPW (as originally approved) after completing two trimesters of study will not be eligible for the award of IARI Merit Medals.

8.1.3 *Procedure of evaluation*

(a) The Board of Studies shall constitute a Special Examining Committee for holding the Common Qualifying Examination. The candidates competing for the IARI Merit Medals shall be awarded marks out of a total weightage of 100 marks at the examination for assessing their comparative merit. (No marks need be awarded in the case of other students, whose progress will be adjudged as satisfactory or unsatisfactory under the normal rules).

(b) The Chairman of the Students' Advisory Committee shall not be a member of this Examining Committee. The Board of Studies of the discipline shall nominate the Chairman and Members of this Examining Committee.

(c) The Examining Committee shall include one member each representing the major areas of specialisation in the discipline and the membership of the Committee shall be limited to five.

(d) The Common Evaluation Committee shall be appointed by the Dean, with the approval of the Chairman Academic Council. All the eligible candidates will present their thesis work before the common evaluation committee during the Convocation Week. The Committee shall award marks which would have 25% weightage in the final evaluation.

(e) The Dean, shall place the results before the Academic Council for consideration, alongwith his recommendations.

8.2 Award of IARI Merit Medals to Ph.D. students

8.2.1 *Eligibility*

(a) The student shall have completed a minimum prescribed load of 25 credits in one academic year in major, minor(s) and other supporting fields excluding Remedial courses/Introductory Agriculture and AIS.

(b) Obtained a minimum overall GPA of 3.75 out of 4.00. Those who obtain 'F' or 'I' Grade in any course or repeat a course are not eligible for award of IARI Merit Medal.

(c) The grades earned in respect of the credits added after the first two trimesters after enrolment shall not be counted for the purpose of award of IARI Merit Medals.

(d) Candidates dropping any course from the PPW (as originally approved) after completing two trimesters of study will not be eligible for the award of IARI Merit Medals.

(e) Obtained a minimum of 70 out of 100 marks at the common written qualifying examination.

(f) The students taking make up examination will not be eligible.

(g) Has not been awarded any disciplinary punishment during the studentship at IARI.

8.2.2 *Procedure of evaluation*

(a) Students whose final viva-voce examinations have been completed on or before the 31st December every year only will be considered for award, as hitherto. Further the students who have not completed the requirements i.e. Final Viva-voce Examination for the award of degree at the Annual Convocation on or before 31st December in the preceding year may also be permitted to present their thesis research/work before the Common Evaluation Committee for consideration of their candidature for the award of IARI Merit Medals subject to the stipulation that they complete the requirements i.e. Final Viva-voce Examination at least two days before the Convocation.

(b) The Dean may, with the approval of the Chairman Academic Council, constitute Special Evaluation Committees on the pattern of inter-disciplinary groups, keeping in view the subject of thesis presented for evaluation. The Special Evaluation Committee may consist of not more than 7 members of whom 2 will be External Members (outside the discipline). The Chairman of the Advisory Committee of students competing for awards will not be included in these committees. The Dean may refer to the SEC the applications received together with the abstracts of theses and authenticated copies of the evaluation reports of external examiners. The full thesis will also be made available to the Committee.

(c) The weightage given to the different aspects for consideration of the award of IARI Merit Medal is given below :

(i)	OGPA	25%
(ii)	Common Written Qualifying Examination	25%
(iii)	Thesis Evaluation	25%
(iv)	Thesis presentation before the Common Evaluation Committee	25%

For calculation of marks in OGPA, 4.00/4 will be treated as equivalent to 100 marks.

(d) On the first working day of January every year, the Board of Studies in each discipline will thoroughly scrutinise the academic records of all students as per item no. 2(I) of the revised guidelines and names of only eligible students will send to the P.G. School for further necessary action.

(e) The Dean will nominate one external expert in the concerned discipline for thesis evaluation of Ph.D. student.

(f) The thesis shall have a weightage of 25% in the final evaluation. However the Committee shall award marks out of 100, keeping different aspects of the these such as importance of the problem, originality of work, practical or theoretical significance, and quality of presentation, etc.

(g) Thesis securing not less than 70 out of 100 marks only will be considered for award of IARI Merit Medals.

(h) The Common Evaluation Committee shall be appointed by the Dean, with the approval of the Chairman Academic Council. All the eligible candidates will present their thesis work before the Common Evaluation Committee during the Convocation Week. The Committee shall award marks which would have 25% weightage in the final evaluation.

(i) In case there is a tie between two candidates, the one having earned the GPA with larger number of credits in the discipline and if there is a tie in this respect also the one having completed the larger course work (i.e. total course load including minors) shall be recommended for the award.

(j) The recommendations of the Committee may be forwarded to the Dean in sealed cover. After getting the recommendations from all Evaluation Committees, the Dean will place the recommendation before the Academic Council for consideration.

8.3 Other medals for M.Sc. students

(a) *Golden Jubilee Medal* : Golden Jubilee Medals; one each in the disciplines of Agricultural Economics, Agricultural Extension, Agricultural Physics, Agricultural Statistics, Agronomy, Biochemistry, Computer Application, Entomology, Genetics, Horticulture, Microbiology, Molecular Biology and Biotechnology, Mycology and Plant Pathology, Nematology; and Plant Physiology are awarded each year to M.Sc. students.

(b) *Desai Biswas Medal* : Donated by Dr. S.V. Desai and Shri S.C. Biswas. The medal is meant for award to students of the discipline of Soil Science and Agricultural Chemistry.

(c) *Narendra Kumar Roy Medal* : Donated by Dr. S.E. Roy for award in Agricultural Engineering.

8.4 Other medals for Ph.D. students

(a) *Indian Council of Agricultural Research Medals* : Medals, one each in the disciplines of Agricultural Economics, Agricultural Engineering, Agricultural Extension Agricultural Physics, Agricultural Statistics, Biochemistry, Genetics, Horticulture, Microbiology, Nematology and Plant Physiology.

(b) *Gurprasad Pradhan Medals* : Donated by Dr. S. Pradhan for award in the discipline of Entomology.

(c) *Suniti Bala Raychaudhuri Medals* : Two medals, one each in the discipline of Soil Science and Agricultural Chemistry and discipline of Mycology and Plant Pathology donated respectively by Dr. Satya Prasad Raychaudhuri formerly Head of the Division of Soil Science and Agricultural Chemistry and Dr. Syama Prasad Raychaudhuri, formerly Head of the Division of Mycology and Plant Pathology.

(d) *G.A. Dastane Medal* : Donated by Dr. N.G. Dastane for award in the discipline of Agronomy.

(e) *Seth Lachhiram Chudiwala Medal* : Donated by M/s Prabhat General Agencies, Bombay, for award to M.Sc./Ph.D. students for outstanding research on Agricultural Chemicals.

(f) *Smt. Nihar Bala Ghosh Medal* : Donated by Dr. A.B. Ghosh for award to the best Ph.D. student of the Institute.

(g) *Assam Government Medal* : Donated by the Government of Assam for significant research on rice.

(h) *W.V. Ramalingam Medal* : Donated by Dr. W.V.B. Sundara Rao for award in the discipline of Microbiology.

B. AWARDS

8.5 Hooker Award

The institute has instituted an award entitled "Hooker Award", for outstanding contributions in any field of research in Agriculture, Animal Husbandry, Fisheries, leading to increase in food production. The award has been instituted on the basis of a legacy bequeathed to the Institute by Mr. and Mrs. Richard Hooker of Longmeadow, Massachusetts, U.S.A. The rules and regulations in respect of this award are given at Annexure VII.

8.6 Dr. S.S. Bains Award

The award named, "Dr. S.S. Bains Memorial Award" was instituted in memory of the late Dr. S.S. Bains, former Head of the Division of Agronomy, IARI, for significant contributions to research in the field of Agronomy. The award is open to all students including the employees of ICAR Institutes who obtain the degree of Ph.D. in Agronomy from any Agricultural University in India in the year pertaining to the year of award. The detailed terms and conditions of the award are given at Annexure VIII.

8.7 Sukumar Basu Memorial Award

The Institute has instituted an Award entitled "Sukumar Basu Memorial Award" for outstanding research in Agriculture including Animal Husbandry and Forestry. The Award has been instituted on the basis of the amount donated by the late Dr. Sib Das Basu to commemorate the name of his brother, late Dr. Sukumar Basu. The rules and regulations in respect of this award are given at Annexure IX.

9 Fellowships*

9.1 Fellowships are offered to assist the students who need financial assistance. This provision is utilised to assist as many students as possible who have good academic record and who are making diligent efforts to pursue higher education. No student/fellowship holder shall apply for or accept any other fellowship/award/employment without the prior approval of the Dean.

**Note :* IARI Junior Fellowship for M.Sc. students is not available since 1993-94 academic session and that for Ph.D. from 1994-95 academic sessaion. Rules and regulations for award of Fellowship are given at Annexure-XXXIII. These shall be applicable as and when the IARI Fellowship (Junior/Senior) can be awarded to students.

9.2 The fellowship/scholarships/any financial assistance will be admissible to persons of Indian Nationality as defined in the Constitution of India or persons domiciled in India, irrespective of sex, race or religion.

10 Academic Requirements for Course and Research Work

10.1 Programme of Studies-Plan of Post-Graduate Work (PPW)

10.1.1 The programme of training in the P.G. School shall be so designed as to give the student a sound mastery of the respective field of specialisation and in the closely related supporting scientific disciplines. The individual programme shall be planned after taking due account of previous academic training of each student.

10.1.2 The programme of studies indicating the Plan of Post-Graduate Work (PPW) of each student shall be finalised by his/her Advisory Committee which shall give considerable latitude in the choice of courses, taking into account the requirement needed to provide training for a high level of scholarship and research in that particular field. The PPW shall be forwarded in the prescribed proforma (Annexure X) for the approval of the Dean by the end of the I trimester of admission and any deviation from the same shall also require the prior approval of the Dean.

10.1.3 Advisement of student admitted under the faculty upgradation scheme shall be carefully planned after taking into account the background of each individual student. If necessary, they may be given a pre-Ph.D. course for one year or package of remedial/core course in the first two trimesters for updating their knowledge, and their further continuance shall be subject to satisfactory completion of such requirement. The grounding in course work shall be fairly extensive and shall cover all the fields of specialisation, within particular major discipline. Appropriate provision for special training and orientation programme may also be made so as to improve their skill and competence as members of the University Faculty. At the end of their Ph.D. programme at IARI they may also be equipped with a set of teaching material which they can use on their return to the respective universities. As part of the Ph.D. programme a tour of about 15 days may be arranged to one or two leading research institutes where they can meet distinguished scientists and also teachers of eminence and repute.

10.1.4 If a student insists on not taking a course suggested by the Advisory Committee for inclusion in the PPW, the concerned Course Instructor shall give the student a test in order to ensure that he/she has adequate knowledge in the course, before permission is given not to include the course in the PPW.

10.1.5 The PPW shall also indicate the tentative subject of the thesis of the student. The topic of the thesis shall be within the major field of specalisation of the student.

10.1.6 Course work shall usually receive primary emphasis during the first part of the student's programme so as to give the requisite background in the scientific disciplines. In the later part the programme shall give greater emphasis to research work. It shall be permissible for a student to complete any remaining course work even during the trimester in which the thesis is submitted.

10.1.7 The Chairman or the Professor, in case the Chairman has not been appointed, should allot maximum course work to the student in the first three trimesters so as to enable P.G. School to judge their suitability to continue their programme as stipulated in para 11.2 of the PGS Calendar. The students are required to maintain OGPA at the levels prescribed in the para 11.2 of the PGS Calendar for entitlement of fellowship and continuance in P.G. School.

10.2 Major and minor fields of specialisation

10.2.1 The programme of studies shall provide a set of core courses in the general field of the student's major specialisation and a secondary grouping of courses in the minor field(s) of specialisation.

10.2.2 An M.Sc. student shall take at least one minor in a supporting discipline outside the student's major field of specialisation.

10.2.3 A Ph.D. student shall take at least two minors in supporting disciplines. A Ph.D. student majoring in one field of specialisation may elect to take as a minor from another field of specialisation recognised as major in the same discipline, but shall be encouraged to take both the minors outside the discipline. This may be decided by the Advisory Committee after carefully examining the background of each student. However, the student shall select at least one minor outside the discipline. Split minors wherever desirable shall also be permissible subject to the condition that both the split minors should be outside the discipline concerned.

10.3 Constitution of Advisory Committee

10.3.1 An Advisory Committee shall be constituted for each student which shall consist of members from both the major and minor fields of specialisation.

10.3.2 Every student shall have a major advisor who shall be from the major field of specialisation to which the student has been admitted. The major guide shall function as the Chairman of the Advisory Committee.

10.3.3 A proposal for the formation of the students' Advisory Committee shall be forwarded in the prescribed proforma (Annexure XI) to the Dean for approval within six weeks of the date of admission of the student.

10.3.4 The Professor of each discipline shall issue a notice listing the names of faculty members who are eligible for allotment of M.Sc./Ph.D. students and who are willing to accept the students together with the area of specialisation of each such faculty member. During the orientation week, the students should meet the different faculty members in their discipline to ascertain the possibilities of conducting research problem in their area of specialisation. Thereafter, the Professor shall ask each student to submit a list of three choices of Chairman by name and the proposed fields of investigation which he/she wishes to undertake as precisely as possible in the area of specialisation of the proposed Chairman. The Board of Studies will take a final decision regarding the choice of major guide and the research problem of each student keeping in view the choice of students and the guidelines regarding allotment of students at annexure XII.

Note: In Divisions where there are large number of faculty members who have not guide even M.Sc. student, the faculty members who are eligible to guide Ph.D. students should not be allotted M.Sc. student and the names of such faculty members should not be circulated to M.Sc. students while calling for their choice of Chairman. The senior faculty members can, however, be nominated as No. 2 in the Advisory Committees of the students.

10.3.5 Departmental students will also submit three choices for nomination of Chairman as per provision in para 10.13.

10.3.6 The Scientific/Technical staff admitted to the post graduate programme at IARI under departmental quota can be relieved after completion of course work and qualifying examination for doing thesis research, provided they have put in 2 years residence. A candidate if admitted in discipline other than the Division in which he/she is borne will be transferred to the discipline in which he/she is admitted for post graduate programme so that he/she may be able to do his/her thesis research in that particular discipline. All such candidates will, however, be required to submit their thesis within the prescribed time limit of 4 and 5 years (M.Sc. and Ph.D. respectively) of their enrolment to the P.G. School.

10.3.7 In case of departmental students, who are admitted in one discipline, but are working in the Divisions not related to the disciplines of admission, the Chairman of the Advisory Committee should invariably be from the major field of specialisation and the immediate supervising officer should be a member of the Advisory Committee, if he/she does not belong to the major field of specialization and he/she is a faculty member.

10.3.8 Staff members transferred from the Regional Research Station for admission to the P.G. School shall take the minimum possible time to complete their course work and qualifying examination and shall return to their Regional Research Station for doing their research work. The research problem shall therefore, be chosen that it is in line with the activities of the Regional Research Station and facilities for it are already available with the Regional Research Station.

10.3.9 The other members of the Advisory Committee shall be suggested by the Chairman of the Advisory Committee in consultation with the Professor of the major and minor disciplines and also with the knowledge and consent of the members concerned. The second member in the Advisory Committee shall be from the students major field and he/she should be eligible to become Chairman of the student in case the original Chairman is not available.

In case of difference of opinion between the Chairman and the Professor regarding nomination of minor adviser, the Dean shall decide the matter in consultation with the Professor of the minor discipline.

10.3.10 No faculty member shall be a member of more than 10 Advisory Committees of the students. However, Dean may give relaxation in deserving cases.

10.3.11 In the case of newly admitted students, the Professor of the discipline shall discharge the functions of the Chairman of the Advisory Committee till the Chairman is chosen as per procedure prescribed above.

10.3.12 A faculty member should normally be allowed to guide a Ph.D. student only after he has guided atleast 2 M.Sc. students.

Note: (1) However, Dean may permit faculty members to guide M.Sc./Ph.D. students, in relaxation of the provision in clause 10.3.12 above, in case where some problems arise due to dearth of faculty members in a particular discipline/ major field, on the recommendations of the Board of Studies with sufficient justification in each case. Normally, Board of Studies shall recommend such cases only when the guidelines at Para 2 of Annexure XVIII have been fully met.

(2) In the disciplines where M.Sc. students have not been admitted, a faculty member, who have not guided 2 M.Sc. students may be permitted by the Dean to guide Ph.D. students in relaxation of the existing guidelines.

10.3.13 The maximum number of students with a particular Chairman at any time shall be restricted to 3 only. The names of Chairman already giving 3 students should be circulated with asterisk mark indicating that they are already having 3 students. Normally, the students' choice will be considered for such of those faculty members who have less than 3 students; and only in the event of non-availability of faculty member in the discipline, the names of faculty members having more than 3 students will be considered for allotment of students. However, even in the later case no faculty member shall be allowed to guide more than 4 students at any time.

A faculty member shall not take more than one student under his/her Chairmanship in an academic year. However, the Dean may give relaxation after considering each case on merit but not more than 2 students in a year in any case.

10.3.14 Persons not working in IARI/IASRI and who are not members of IARI faculty shall not be appointed as Chairman or Members of the Advisory Committees of the students except with the prior permission of the Dean.

10.3.15 No departmental student shall be allowed to teach or guide students. However, a faculty member who is registered with an outside university for higher studies may be permitted in special cases to teach a course but shall not be allowed to act as a Member or Chairman of a student's Advisory Committee.

10.3.16 Whenever the Chairman of a student's Advisory Committee leaves the Institute or is transferred from the headquarters, the second member from the student's major field should take over as Chairman and the vacancy so caused in the membership of the major field shall be filled up by appointment of another faculty member. The second member shall, therefore, be closely associated even in the preliminary discussions while formulating PPW and outline of research work (ORW).

10.3.17 If a faculty member functioning as Chairman/Member in the student's Advisory Committee(s) goes abroad or is absent on other grounds for more than three months in the case of the Chairman and six months in the case of others, his/her name on the Advisory Committee shall immediately be substituted by a new Chairman/Member. The new Chairman/ Member shall continue to function as such even after the return of the original Chairman/ Member. No last minute substitution in the Advisory Committee of a student shall be made for conducting examinations except in special cases with the prior approval of the Dean.

Note: (a) In Divisions where a large number of faculty members go abroad on deputation for training or where special situation exists, the Board of Studies will examine each case individually and forward a proposal to the Dean for relaxation of this rule, where necessary. The Dean may give relaxation in suitable cases upto 6 months.

(b) No faculty member who is due to retire within 24 months/36 months from the date of formation of the Advisory Committee of the students can be nominated as Chairman of a M.Sc./Ph.D. students respectively, in order to ensure that the work of the student is not hampered particularly at the final stages of his/her studies. Such faculty members can, however, be nominated as members of the Advisory Committee of a student.

10.4 Syllabus and organisation of programme of teaching

10.4.1 The subjects, courses thereunder, the pre-requisites, the detailed syllabus and the course numbers, etc. in respect of each discipline are given in Chapter 19. The courses listed represent the total syllabus in respect of each discipline; the actual list of courses to be offered in a particular academic year or trimester shall be decided by the Board of Studies of each discipline after taking into account available facilities and faculty strength. If any course is not to be offered in a particular trimester scheduled for it, notice shall be given well in advance.

10.4.2 The taking of a pre-requisite course whenever prescribed may not be a mandatory provision in all cases. If the Advisory Committee and the course instructor are satisfied that in the case of a student, it is not necessary to insist upon taking a pre-requisite course, considering the student's academic background, the student may be exempted from taking the pre-requisite course.

10.4.3 The courses shall be organised as discrete units or blocks of subject matter and shall be assigned a certain number of credits. One credit shall represent approximately 12 hours of lectures (one hour per week for 12 weeks) and the necessary reading and preparation outside the class required for mastery of the subject matter. In the case of practicals, one credit represents approximately 12 practicals normally of 3 hours' duration each. Each course shall, in general, be so planned that it may be completed within a given trimester.

10.4.4 A proposal for introducing a new course or revision of the course shall first be submitted in the prescribed proforma (Annexure XIII to the Board of Studies of the discipline concerned. The proposals of the Board of Studies shall be considered by the Standing Committee on Courses, Curricula & Academic Affairs and the recommendations of the Standing Committee shall then be placed before the Academic Council for final approval.

10.4.5 There should be at least two faculty members available in a discipline having specialisation in the area in which a new course is proposed to be started.

10.4.6 There shall be no rigid rule or guideline regarding the minimum number of students required for offering a course. It may be necessary to offer the course even for a single student. If the demand for a particular course is likely to be limited, the notice for dropping the course shall be given well in advance.

10.4.7 Matters regarding the allotment of courses, designation of Scientists as course leaders and course associates shall be decided by the Board of Studies in each Discipline well in advance of the start of a trimester. The Board of Studies should however, maintain liaison with the Faculty of the Discipline in this regard.

10.4.8 Generally, only one instructor shall be made responsible for teaching a course. However, in certain special cases, it may be necessary to associate other persons with the teaching of the courses. In such cases, only one instructor should be designated as course leader. The total number of instructors with the teaching of the course shall generally be not more than three including the staff members assisting the conduct of practical classes.

Note: The teaching load of the Course Leader should not be less than 30 per cent. In exceptional cases where more than 3 instructors are required to be associated with a course because of the specialized nature of the subject or because the course is of five credits or more, the Board of Studies should give proper justification based on which the Professor will obtain the approval of the Dean. There will be no objection to designate a non-faculty members as Course Leader; if, however, faculty members are available for teaching the course, the Board of Studies should not designate non-faculty members as course leader.

10.4.9 Before the trimester begins, full syllabus of the course indicating datewise schedule of lecture topics and practicals, schedule of examination and the weightage to be given for various types of examinations and the basis for award of grades in the course shall be prepared for the information of the students. This shall be given in the very first lecture of the course. A copy of the same may be given to the Professor also.

10.4.10 When a course is shared by more than one teacher, their names shall be mentioned against the lectures to be delivered by them. In such cases the Course Leadership may be given; by rotation and this may be decided by the Board of Studies after taking into consideration the quantum of work done by each teacher associated with a course.

10.4.11 The course leader shall have the overall responsibility for organising teaching conducting examination, submission of results etc., but he/she shall consult the others associated with him/her in such matters.

10.4.12 The maximum number of courses under the charge of each instructor shall be two in an academic year. In exceptional cases, an instructor may be made incharge of three courses with the permission of the Dean.

10.4.13 Guest lectures may be invited to give lectures on some highly specialised topics only, as supplemental to the work done at IARI and not or covering part of specific courses.

10.5 Language requirement

As the medium instruction at the institute is English, the students shall be expected to be able to write, read and speak English fluently and be able to prepare high quality research paper in English. If a candidate's knowledge of English is founded deficient, he shall be required to undergo a course in English and the duration of his study shall, if necessary, be extended for this purpose.

10.6 Credit requirement

10.6.1 The number of credits of course work required for each candidate shall be specified by the Advisory Committee of the candidate subject to the guidelines on the subject and approved by the Dean.

10.6.2 A minimum of 45 (55 for courses in Agricultural Statistics) credits of successful post-graduate work shall be required for students preparing for M.Sc. degree in addition to any remedial/Introductory Agriculture course prescribed and the course on Agricultural Information System. At least 20% of the course work shall be in fields outside the major discipline.

10.6.3 In the case of students preparing for Ph.D. degrees, no specific minimum requirement shall be fixed with regard to credits of successful course work and the same shall be specified by the student's Advisory Committee in each case. However, the programme will include at least two minors each having a minimum of 9 credits. The students may also be assigned course in other supporting disciplines (not taken as minor field of study) depending upon the requirements, to provide training for a higher level of scholarship and research in their particular fields.

Note: Ph.D students competing for award of IARI Merit Medals should have completed a minimum prescribed load of 25 credits in one academic year. Please See Chapter 8.

10.6.4 A student's programme of studies shall not include more than 15 credits in any particular trimester. Recipients of certain assistantship may not normally be allowed to take more than 9 credits in a trimester. However, the Dean may grant marginal enhancement of the ceiling of credits in case of students taking remedial/Introductory Agriculture courses after examining each individual case on merit.

10.6.5 A departmental student's programme of studies shall not include more than 15 credit in a particular trimester. Marginal enhancement of the ceiling of credits in case of students taking remedial/Introductory Agriculture courses would be granted by Dean on merit of each case.

10.7 Submission of roster

10.7.1 Each student on rolls, whether taking course work or not, shall submit on the registration day of each trimester a roster in the prescribed form (Annexure VI) to the

Professor of the discipline indicating the courses for which he would be registering in that particular trimester. If a course is taken without inclusion in the roster, the grades earned in that course will not be counted, unless permitted by the Dean.

10.7.2 No course shall be entered in the roster unless it is included, in the PPW of the student.

10.8 Core courses

10.8.1 Each discipline shall prescribe a set of core courses for students majoring in that discipline which are considered as the irreducible minimum and which the students should successfully complete in order to ensure the requisite and basic knowledge necessary for qualifying for a degree in that particular discipline. The core courses are indicated under each discipline in Chapter 19.

10.8.2 Core courses shall be prescribed separately for M.Sc. and Ph.D. students. A discipline may also prescribe courses from other disciplines as core course, if such courses are considered essential for acquiring the requisite standard of knowledge in the students' major field of specialisation.

10.8.3 The prescribed core courses shall be counted towards the minimum requirement of 9 credits in respect of the minor field(s) of specialisation.

10.8.4 A student desirous of seeking exemption from undertaking the prescribed core course(s) shall undergo the qualifying examination(s) to be conducted in each discipline at the satisfactory completion of which exemption shall be granted from taking the core courses. Ph.D. students may be exempted from taking a core course if the same has already been taken at M.Sc. level at IARI.

10.8.5 The PPW of each students shall be drawn up only after the core courses to be taken are decided.

10.9 Auditing of courses

On the recommendation of the Advisory Committee a student shall be eligible to add to his PPW any course, other than core course, for auditing. The prescribed attendance shall be maintained and the scheduled examination shall also be taken even while a course is registered for auditing and the performance of the student shall be marked as satisfactory/ unsatisfactory. The details of such audited courses shall be given in the grade card and the transcript.

10.10 Remedial courses

10.10.1 Students who have not been exposed to Agricultural scientific disciplines in their Bachelor's or Master's degree programme, shall be required to take the following courses:

A. For students admitted upto the academic session 1991-92

(i) Principles of Crop Production and Rabi Crops (1L+2P)I (RC-1)

(ii) Kharif Crops (2P)III	(RC-2)
(iii) Basic Plant Protection (3L)I	(RC-3)
(iv) Introductory Soil Science (3L)I	(RC-4)

Details of these course are listed in Chapter 19 under the respective disciplines.

B. Courses on Introductory Agriculture (For students admitted w.e.f. 1992-93 academic session)

A-1 Principles and Practices of Crops Production (2L+2P)-I

A-2 Principles and Practice of Horticulture Crops (2L+2P)-I

A-3 Soil and Agriculture (2L+1P)-I

A-4 Insect/Mites/Nematode Pests of Agricultural Importance and their Management (1L+2P)-I

A-5 Elementary of Cytogentics and Plant Breeding (1L+1P)-I

A-6 Crop Morphology and Physiology (1P)-I

A-7 Crop Diseases and their Management (1L+1P) Summer Vacation

A-8 Agricultural Economics (1L+1P) Summer Vacation

A-9 Basics of Extension Education (2L+1P) Summer Vacation

10.10.2 Students who had not obtained a Bachelor's or Master's Degree in Agricultural Sciences but claim exemption from attending the remedial courses/courses on Introductory Agriculture on the grounds of having been previously exposed to the Agricultural discipline at either Master's or Bachelor's level, can be given exemption only if they are able to pass the qualifying examination in the respective remedial course(s)/course(s) on Introductory Agriculture.

10.10.3 The remedial courses/courses on Introductory Agriculture shall be over and above the prescribed minimum credit load for the M.Sc./Ph.D. degrees and will be graded and counted for calculating GPA like regular courses.

10.10.4 The concerned Advisory Committee shall recommend the exact time schedule for taking the remedial courses/courses on Introductory Agriculture and indicate whether any extension of the minimum period of study is required for taking the extra load.

10.10.5 The students shall maintain the prescribed attendance in the remedial courses/courses on Introductory Agriculture and sit for the examination. Their performance shall be graded as in other courses. However, the credits and grades in respect of the remedial courses/courses on Introductory Agriculture shall not count towards the minimum credit requirements of the student or for award of IARI Merit Medals or any prize.

10.11 Agricultural Information System

From the 1983 academic session a one credit course in Agricultural Information System has been introduced as a compulsory course for all post graduate students. This course will be over and above the prescribed minimum credit load for M.Sc./Ph.D. degrees and will be graded and counted for calculating GPA like regular courses. The details of this course are listed in Chapter 19.

10.12 Seminars

10.12.1 Each student shall be required to give seminars during the course of his/her studies on a topic relevant to the discipline concerned. The number of seminars to be taken by each student should be two in major and one in the minor fields in the case of Ph.d. students and two in the major field in the case of M.Sc. students.

Note: Out of 3 seminars prescribed for Ph.D. students one should be in the minor field outside the discipline. It is compulsory for the students to secure 75% attendance in the seminar.

10.12.2 The procedure for selection of seminar topics, preparation of synopsis, evaluation of seminar, write-up of seminar, etc. is given at Annexure-XIV.

10.13 Outline of Research Work (ORW)

10.13.1 An outline of research work (ORW) of a student in the prescribed proforma (Annexure XV) and recommended by the Chairman and Members of the Advisory Committee shall be sent for approval of the Dean by the end of third trimester from the date of admission.

10.13.12 The procedure for formulation and finalization of ORW shall be as under:

(a) In the first instance, the student and the Chairman may prepare a draft ORW after discussing in detail the problem chosen to ensure the full involvement of the student in the research problem. The draft ORW should indicate in detail the method of tacking the problem, the various facilities required in the terms of land, equipment, chemical etc., the Division where such facilities are available, and the time schedule for completion of the research work. If facilities available in another Division are to be utilized, the Chairman may consult the Division concerned regarding its availability.

(b) The draft ORW may be discussed by the Advisory Committee of the student and the Professor may be informed of this to join the discussion. This should be done by the end of second trimester or the beginning of the third trimester.

(c) The draft ORW approved by the Advisory Committee should be given to the Professor and Head of the Division for discussion.

(d) There should be a common seminar in each division for presenting ORWs of the students in which all the faculty members and students would participate to ensure full interaction. In the seminar the student shall explain in brief the nature of the problem and the techniques to be adopted for tackling the problem.

(e) The ORW may be finalised by the student and the Chairman in the light of the discussion in the seminar and forwarded to the Dean's office through the Professor by the end of III trimester. A copy of the ORW should be sent to the Division concerned, if the facilities of that division are proposed to be utilized.

(f) If necessary the ORW may be revised subsequently in the light of difficulties faced in tackling the research problem. If there is any difficulty in following the above procedure in exceptional individual cases the reasons for the same may be forwarded to the Dean for consideration.

10.13.3 Once the commitment regarding the use of the facilities has been given in the ORW, the officer concerned shall take all necessary steps to ensure that the student is in a position to utilise the equipment and get the work done quickly. The Chairman of the Advisory Committee shall also pursue the matter with the establishment concerned.

10.13.4 The students may have to visit, if their training so requires, different research institutions and sub-stations of the Institute. They shall be entitled to the payment of second class railway fare etc., as terms specified under the relevant fellowship rules.

10.14 Inter-Institutional collaboration in research work

The Institute has provision for inter-institutional collaboration in the investigation of the research problems chosen by the post-graduate students. The Institute has a fruitful phase of collaboration in the post-graduate education both with the USAID and the International Rice Research Institute, Manila. The latter programme has now been revised from 1983-84. In addition, the Institute permits student to conduct field experiments and research work in approved research institutes after taking in to account the needs of the students and the nature of the research problem.

10.15 Attendance and leave

10.15.1 All students shall attend a minimum of 75 percent of the total number of lectures and practices separately in each course.

10.15.2 If a student falls short of required attendance in lectures, practicals or field work by 5 percent or less in any particular course, the shortage may be condoned by the Dean provided (i) it is made up in the aggregate and (ii) the shortage was due to unavoidable circumstances.

10.15.3 Students falling short of the prescribed minimum attendance in the particular course shall not be permitted by the course leader to take the examination for that course without prior approval of the Dean.

10.15.4 The Head of the Division shall be competent to sanction leave to students for a period not exceeding a full trimester during the entire course of studies for sufficient and valid reasons under intimation to the P.G. School for record. The award of fellowship during the leave period shall be determined as per the terms and conditions of the fellowship scheme under which the student is receiving the fellowship.

10.15.5 Cases of absence of more than one trimester due to illness of the student may be decided by the Dean on the recommendation of the Medical Officer and in case of absence for any other reasons, the Dean shall examine each case on merit and decide the matter.

10.15.6 Cases of students remaining on unexplained absence for more than 15 days shall be promptly reported to the P.G. School office by the Divisions and the Hostel Office, and the names of those students shall be struck off from the rolls for unauthorised absence.

10.16 Residential requirements and duration of studies

10.16.1 The minimum residential requirements for both the M.Sc. and the Ph.D. degrees is 2 academic years from the date of admission.

This requirement shall be treated as satisfied in the cases in which a student submits his thesis any time during the sixth trimester of his residentship at the IARI.

10.16.2 The maximum time limit for completion of the M.Sc. programme of studies is 4 years and for Ph.D. degree is 5 years from the date of admission.

10.16.3 The departmental candidates will be required to submit their thesis within the prescribed time limit of 4 and 5 years for M.Sc. and Ph.D. course respectively, as in the case of regular students mentioned at para 10.16.2.

10.16.4 The date on which the thesis is submitted shall be taken as the date for the purpose of calculating the maximum time limit prescribed.

10.16.5 The time limits mentioned shall be inclusive of all interruptions (except the interruption due to name being struck off from the rolls) and shall not be relaxable except on medical ground. The following procedure will govern requests for extension of time limits:

(i) Whenever any event takes place which is likely to delay the submission of thesis, such event shall be duly reported through the Progress Report.

(ii) All requests for extension must be received in the P.G. School three months in advance of the last date for submission of thesis (including the extended date).

(iii) Dean may grant extension upto six months provided he is fully satisfied that the causes of the delay is beyond the control of the student.

(iv) In exceptional circumstances the Dean may grant extension of six months, wherever necessary, with the approval of the Chairman, Academic Council and no further extension shall be granted thereafter.

10.17 Review of student's progress in course and research work

In order to review and continuously watch the progress of the students in both the course work and the research work, each student shall submit, at the end of each trimester, a progress report in the prescribed proforma (Annexure VII). The following guidelines shall be observed in this regard:

(a) The trimester progress report shall be reviewed by the Chairman of the Student's Advisory Committee and in case of any difficulty faced by the student, the entire Advisory Committee shall review his trimester progress.

(b) Two copies of this report may be submitted to the Professor, one of which shall be sent immediately to the P.G. School.

(c) The Professor in each discipline will prepare an overall resume of the progress of students in that discipline which will include the cases of students where special problems are faced.

(d) The Board of Studies in each discipline will meet at the end of each trimester and consider this resume for taking appropriate action under intimation to the Dean.

10.18 Student discipline

10.18.1 The Dean, Post-Graduate School is charged with the general control of students and the maintenance of discipline.

10.18.2 The Dean shall have the discretion to remove a student from the rolls of the P.G. School for any of the following reasons:

(a) Failure to profit by the course of studies.

(b) Misbehaviour.

(c) Failure to pay the prescribed fees and dues in time without prior permission.

(d) Continuous absence from studies without prior permission.

10.18.3 A record of the students found guilty of misdemeanour/indiscipline along with details of such incidents shall be kept in the P.G. School for future reference and consultation, if any.

10.18.4 If any property/equipment in the campus is damaged and loss caused to the Institute as a result of demonstration/strikes resorted to by the students, the loss would be recovered either directly from the persons specifically identified where possible; or else collectively from such groups or associations as were responsible for organising the demonstration/strike.

11 Examination System

COURSE WORK

11.1 Grading

11.1.1 A system of grading shall be adopted for assessing the student's progress in overall course work. The cumulative performance of students in course work shall be recorded in terms of Grade Point Average (GPA).

11.1.2 The maximum Grade Point Average attainable shall be 4.

11.1.3 The grading system shall be as follows:

Excellent	:	A (4 grade points per credit)
Good	:	B (3 grade points per credit)
Average	:	C (2 grade points per credit)
Poor but pass	:	D (1 grade point per credit)
Failed	:	F (0 grade point per credit)

11.1.4 Every student shall obtain the prescribed grade in all the courses taken by him/her to fulfil the course requirements for the degree.

11.2 Minimum GPA required

11.2.1 A student shall have to earn the following minimum GPA (cumulative) for continuing in the P.G. School and for passing the final examination.

	GPA for continuing	*GPA for passing*
M.Sc.	2.10	2.40
Ph.D.	2.40	2.70

11.2.2 The minimum GPA (cumulative) for continuing in the P.G. School shall be earned at the end of the third trimester. A student who fails to satisfy this requirement shall not be permitted to continue in the P.G. School. This rule shall be relaxed with the approval of the Academic Council in special cases, if the student concerned has made a substantial improvement in his/her GPA by attaining GPA of 2.40 in the case of M.Sc. and 2.70 for Ph.D. or above on a course load of 9 credits or more during the third trimester. This average of 2.40 for M.Sc. and 2.70 for Ph.D. shall also be earned in courses taken in the subsequent trimesters until the minimum cumulative GPA average of 2.10 for M.Sc. and 2.40 for Ph.D. is attained.

Note: Students who do no obtain minimum GPA at the end of the third trimester may be permitted by the Dean to continue in the IV trimester provided he is satisfied on the recommendations of the Advisory Committee that the concerned student has the potentiality to improve his/her grade by the IV trimester.

11.2.3(i) By the end of the VI trimester of his/her residence in the School, the student shall have to attain cumulative GPA of 2.40 in the case of M.Sc. and 2.70 in the case of Ph.D.

(ii) Student failing to attain this level shall not be permitted to continue or qualify for the degree at the P.G. School.

(iii) Dean shall himself dispose of requests for continuation beyond the VI trimester in the cases where the GPA of the student concerned falls short of the prescribed minimum requirement by not more than 0.1. The case of the student whose GPA deficiency exceeds 0.1 may not under any circumstances be considered for continuation beyond the VI trimester and shall not be referred to the Council for relaxation.

11.2.4 The prescribed "continuing GPA" and "passing GPA" shall have to be earned and maintained subsequently by the end of their third and sixth trimesters of admission respectively by the Departmental Students.

11.2.5 A student may repeat once a course in which he, he gets a grade below 'B' and that too on the recommendation of the Advisory Committee. In case a course is repeated the grade obtained on repetition alone shall be counted for calculating the overall grade point average. The transcript will reflect all the courses taken including the courses repeated.

11.3 Trimester examinations

11.3.1 All students shall have to take examinations given by the instructors concerned in the various courses registered by them in that particular trimester both in the major and minor fields. The types of examinations and the weightage attached to each, including practicals shall be announced by the course instructor at the commencement of the trimester. Generally the examination shall be of the following types:

(a) Short quizzes (announced and unannounced) to be held periodically.

(b) Mid-term examination to be held between the sixth and seventh week of commencement of the trimester.

(c) Term paper(s) as may be decided by the course instructor. The term papers given should be presented in the class.

(d) Final trimester examination: The written and practical examinations held at the end of each course should be followed by an oral discussion with the student before the marking is done.

11.3.2 A schedule of final trimester examination for each trimester shall be circulated by the P.G. School.

11.3.3 In order to check use of unfair means at the various examinations, the following regulations shall be followed:

(a) The invigilation at the examination shall be done by the instructor himself and not by anybody else.

(b) A student found adopting unfair means at the examination for the first time shall be given 'F' grade in that course by the instructor himself. The decision of the instructor shall be final. The instructor shall send a report to this effect to the Professor and the Dean.

(c) In case a student is found adopting unfair means at the examination for a second time, he shall be awarded 'F' grade in that course by the instructor himself and the matter reported to the Dean. The Dean shall take action for rusticating him from the P.G. School for one year.

(d) A student adopting unfair means at the examination for the third time shall be expelled from the P.G. School by the Dean.

(e) In case a departmental student is found adopting unfair means at the examination, apart from taking action as mentioned above, the matter shall also be reported to the competent authorities for initiating action for violation of conduct rules with particular reference to the provision requiring a high code of conduct and behaviour from public servants.

11.3.4 The instructor shall be responsible for juding and grading the student's performance and their mastery of the material covered in the various courses taken by them through a system of quizzes, term papers, mid-term examination and a final examination. The course instructor shall, as a rule, show the answer books to the students in respect of the various examinations and discuss the same with them. For facilitating this discussion, the course instructors may themselves declare grades at the end of the evaluation and discussion with students shall be completed within two days of such declaration and the grade communicated to the P.G. School in the Proforma at Annexure XVI within 7 days of the examination. The course instructor shall certify that the types of examinations and the weightage attached to each course including practicals had been announced by him at the commencement of the trimester.

11.3.5 A student failing to attain the prescribed minimum of 75 per cent of attendance separately in lectures and practicals in any course shall not be permitted by the instructor concerned to sit for the final trimester examination for that course without prior approval of the Dean. (c.f.10.15.1, 10.15.2 and 10.15.3).

11.3.6 All examinations prescribed shall be taken by the student and absence from examination shall not be permitted without valid reasons such as illness, to be certified by the Institute's Medical Officer. The student shall, however, has to obtain written permission from the instructor concerned before absenting himself from any examination.

11.4 Make-up examination

11.4.1 The following guidelines shall be followed while giving make-up examination:

(a) *Quizzes* : No make-up test in lieu of missed quizzes shall be allowed. In exceptional circumstances when a student misses quizzes in a trimester on account of illness or any other bonafide cause and the leave of absence has been duly sanctioned, the Dean may, on the recommendation of the instructor/Chairman concerned, permit that the grades of the students be determined on the basis of his/her performance in the remaining examinations after excluding the total marks of the quizzes missed.

(b) *Mid-term examination* : Make-up examination shall ordinarily be given in lieu of only one-mid-term examination missed by the student save in exceptional circumstances. The make-up examination shall be given only after the Dean has accorded his permission to the student to take the make-up examination. Such make-up examination shall be completed before the end of the eleventh week of the trimester. A make-up examination shall be given at one time only to all such students. It shall be the responsibility of the students concerned to present himself to one instructor for the make-up examination at the end of the examination missed after obtaining the necessary permission of the Dean. The instructor shall fix a suitable date and time for the make-up examination.

(c) *Final trimester examination* : Normally no make-up examination shall be permitted in lieu of the missed final trimester examination except with the approval of the Dean and subject to the following conditions:

(i) If a student fails to appear at any trimester final examination for really valid reasons such as illness an application shall be filed with the course instructor on the very date on which the examination is missed.

(ii) The application for make-up examination must be supported by the medical certificate from the Institute's Medical Officer and the report should be routed through the Master of Halls of Residences and the Chairman concerned.

(iii) No application for make-up examination shall be considered if it is not received within 24 hours from the expiry of last date of the trimester final examination.

(iv) The make-up examination for the final trimester examination missed shall be held within 15 days of the starting of the following trimester.

(v) The grade awarded in make-up examination shall carry notation 'X' with the remarks that this grade has been obtained by appearing in make-up examination. The student receiving the grade in make-up examination shall not be eligible to be considered for the award of the IARI Merit Medal.

11.4.2 If a student had to drop a course on valid and bonafide medical grounds after the last date prescribed for such purpose and without completing 75% of the attendance, the student shall be given 'I' grade, i.e. "Incomplete", and may be allowed to repeat that course. The "I" grade shall be entered in the transcript also. In all other cases of dropping of courses after the prescribed date, the student shall be awarded "F" grade in the course.

11.4.3 The time for dropping of courses included in the roster will be 6 weeks. The period for adding course after registration will be 15 days.

11.4.4 In case a student could not take the mid-term or final examination, or make-up examination, average of the marks obtained by him/her in all the examinations held in the trimester shall be taken under intimation to the P.G. School Office. For purposes of averaging all examinations including the ones missed shall be taken into consideration and the examination missed shall be awarded zero mark.

11.5 Grade cards

11.5.1 The P.G. School shall enter the results of the trimester examinations in a register and shall issue a grade card (proforma at Annexure XXVII) to each student at the end of every trimester indicating the grades obtained in the courses offered in that trimester.

11.5.2 Any discrepancy in the grade card issued shall be reported to the P.G. School within 30 days of the issue of the grade card.

11.5.3 Individual cases where "F" has been shown in the grade card may be re-considered for the deletion of the "F" grade if it is conclusively proved within 30 days of the issue of the grade card that a student had not undertaken the examination in that course on the advice of his major advisor.

11.6 Transcript

A transcript in the prescribed proforma (Annexure XXVIII) showing the cumulative performance of the student in course work shall be issued, on request, by the P.G. School at the completion of the entire course work. If a student wants a transcript even before completion of the course work the same shall be issued to him/her on payment of the prescribed charges and on proper justification.

B. QUALIFYING EXAMINATION

11.7 Proposal for holding qualifying examination

11.7.1 After having successfully completed the major portion of the course work required (at least 75%) as judged from the minimum average grade point prescribed for passing (2.40 for M.Sc. and 2.70 for Ph.D.) a pre-comprehensive oral examination shall be held by a common departmental committee to be nominated by the Board of Studies of the discipline. The pre-comprehensive oral examination shall be conducted only after the student has successfully completed the common written qualifying examination in the major and/or minor fields. Thereafter a qualifying examination shall be held to test each student's general mastery of the concerned scientific discipline and his general fitness for becoming a candidate for the degree.

Note: The pre-qualifying examination should be held only once and if it is clear that the student is not ready for the final qualifying examination, it is obvious that sufficient time should be given to him to prepare for it. Normally it will be very difficult, if not impossible, for a student to overcome the weakness over a period of two to three weeks. It may take as much as two to six months for the required preparation. This fact should be kept in view while determining the date for the qualifying examination based on the pre-qualifying performance.

The common departmental examination committee which may be nominated by the respective Board of Studies should include, besides the Professor and the Head of the Division, faculty members representing all the major fields/sub-disciplines and also the Chairman and in his absence the second member of the Advisory Committee of the student appearing in the pre-qualifying examination. The strength of the Committee shall not exceed 6-7 members including the Chairman who shall normally be the Professor and in his absence the Chairman of the Advisory Committee of the student.

The Board of Studies may prescribe a time gap shorter than 2 months for holding the qualifying examination in the case of M.Sc. students.

11.7.2 The Chairman of the Advisory Committee shall forward in the prescribed proforma (Annexure XIX) to the Professor of the discipline concerned a proposal for holding qualifying examination of the concerned student after completion of 75% of the course work both in the major and minor fields (as already listed in his approved PPW), indicating therein the schedule of examination including the proposed dates of written and *viva-voce*. The chairman of the Advisory Committee shall suggest a panel of three names for considering the co-opted member of the Examination Committee for the qualifying examination to which the Professor shall add two more names before forwarding the panel to the Dean. The Head may also, if he likes, add any names to the above panel. Where the Professor himself is the Chairman of the Advisory Committee, the Professor will suggest three names and the Head shall suggest two more names for the panel. Similarly, when the Head is the Chairman, he would suggest the first three names and Professor shall suggest two more names for the panel.

11.7.3 After examination of each student's record, permission of the Dean shall be conveyed to the Professor under intimation to the Chairman concerned to proceed with the qualifying examination. The qualifying examination should normally be completed within a period of three months from the date of issue of the letter from P.G. School permitting such an examination.

11.7.4 The Dean shall also nominate the co-opted member in the examination committee and take such action as may be required in arranging for the participation of the co-opted member.

11.8 General requirements for qualifying examination

11.8.1 The examination shall be both written and oral, the written test to precede the oral. The oral examination shall be held only after the student has successfully completed the written examination.

11.8.2 The written qualifying examination in the major field both for the M.Sc. and Ph.D. shall be held on a common basis in each discipline at suitable intervals (say once in a trimester) to be notified at least one month in advance. The procedure for conducting the common written qualifying examination, including setting up of questions papers evaluation of answer books etc., shall be decided by each discipline in consultation with the academic bodies within the discipline.

11.8.3 The qualifying examination can be held at any time during the academic year, including the summer vacation.

11.8.4 For holding qualifying examination and final *viva-voce*, notice of a minimum period of 10 days shall be given and no prior approval of the members of the Advisory Committee shall be required. Faculty members shall so arrange their programme that they are present at the time of the student's examination. No last minute substitution in the Advisory Committee of students will be made at the time of examination except in special cases with the permission of the Dean.

11.8.5 The qualifying examinations shall be given at least 3 months in advance of the date of completion of the student's programme of studies (i.e. the date on which the final *viva-voce* examination is held) in the case of M.Sc. students and six months in advance in the case of Ph.D. students.

Note: The Dean is empowered to relax this rule on the recommendation of the respective Board of Studies in suitable cases.

11.8.6 Normally departmental *part-time* students (both M.Sc. and Ph.D.) shall complete their qualifying examination within six trimesters of admission to the Post Graduate School. The maximum limit for this purpose shall in any case not exceed nine trimesters from the date of admission.

11.8.7 *For Departmental students admitted in 1980-81 and onwards*

After having successfully completed the major portion of the course work required (at least (75%) as judged from the minimum average grade point prescribed for passing (2.40 for M.Sc. and 2.70 for Ph.D.), the departmental students shall appear for qualifying examination in not later than the V trimester.

11.8.8 Any member of the Post Graduate faculty shall have the option to attend the *viva-voce* of any student as an observer.

11.9 Qualifying examination for M.Sc. students

The written qualifying examination for M.Sc. students shall consist of one or more papers, each of not more than three hours' duration, covering suitably the subject matter of the courses taken by the student in the major field and one paper of two hours duration covering the minor fields. The papers in the written examination in respect of M.Sc. programme shall be set and evaluated in accordance with the procedure to be decided by each discipline in the light of provisions contained in para 11.8.2. The paper in the minor field shall be set and evaluated by the member of the student's Advisory Committee representing the minor fields, and shall be conducted by the Advisory Committee with one additional member designated by the Dean from among the faculty members of IARI, but from a discipline other than the student's major field.

11.11 Qualifying examination for Ph.D. students

The written qualifying examinatioin for Ph.D. students shall cover, besides the courses taken by the student in major and minor fields, all aspects of the major discipline of study in which the degree is to be awarded, irrespective of the particular courses taken in the discipline. There shall be three or more written papers, one or more each of three hours' duration covering the major field and one each of two hours' duration covering the the two minor fields. For Ph.D. programmes, the papers for the written examination in the major field shall be set and evaluated in accordance with the procedure to be decided by each discipline as per provisions of para 11.8.2. The papers in the minor field shall be set and evaluated by the members of the student's Advisory Committee representing the minor field. The oral qualifying examination for Ph.D. shall be conducted by the Advisory Committee with one additional member who will be designated by the Dean and shall be a specialist in the student's major field but from outside the IARI and its regional research station.

11.11 Report on the performance in qualifying examination

11.11.1 The Chairman of the student's Advisory Committee shall act as Chairman of the Examining Committee and shall be responsible for communicating the results of the examination through the Professor to the Dean, in the prescribed form (Annexure XX) and with the signatures of all the members of the Examining Committee.

11.11.2 The student's performance in the qualifying examination may be considered satisfactory on the unanimous recommendation of the Examining Committee. It shall be within the competence of the Committee to indicate deficiencies in the student's course work and over-all training at this stage and the Committee may recommend that the student makes up these deficiencies in any suitable manner.

11.12 Qualifying re-examination

11.12.1 A student failing in one or more subjects in the written examination shall be re-examined only in that/those subjects and the *viva-voce* shall be held only after the written examination is successfully completed, provided that there is not more than two months' gap between the written examination and the *viva-voce*. If a student fails in the viva-voce, the Examination Committee shall make specific recommendations as to whether the student is to be re-examined in the *viva-voce* alone or in the written portion also.

11.12.2 A student failing in the qualifying examination shall apply for permission to appear for a second time to the Dean with the recommendation of the Chairman of the Advisory Committee. Permission to appear for a second time may be given, but re-examination shall not take place earlier than three months after the first examination. Re-examination for a third time is not permitted and a student failing for a second time cannot continue or qualify for a degree from the P.G. School.

11.13 Admission to candidacy

A student who has passed the qualifying examination shall be admitted to candidacy for the degree. Formal intimation to this effect shall be communicated to the student, the major adviser and the Professor.

C. THESIS SUBMISSION, EVALUATION AND FINAL VIVA-VOCE

11.14 Topic of the thesis, its standard and format

11.14.1 The topic of thesis shall fall within the major field of specialisation in which the student has been admitted. The subject of thesis shall have the approval of the student's Advisory Committee and the Dean at the time of formulation of the student's plan of post-graduate work (PPW). The thesis shall be based on the results of the student's own work.

11.14.2 The thesis for the Master's degree should be of such nature as to indicate a student's potentiality for conducting research. The thesis for Ph.D. must indicate that the candidate possesses the ability and imagination necessary to do independent constructive thinking and should be of the nature of a definite contribution to the subject and the results and the conclusions presented should be of sufficient importance as to merit publication.

11.14.3 It shall contain chapters on Introduction, Review of Literature, Materials and Methods, Results, Discussion, Conclusions and Literature Citations.

11.15 Submission of thesis

11.15.1 (i) Each student shall submit to the Chairman at least two months before the proposed date of actual submission of the thesis a proposal for submission of the thesis in the prescribed proforma (Annexure XXI) which shall be signed both by the Professor and the Head of the Division with comments, if any, and forwarded by the Professor to the Dean.

(ii) The Chairman of the Advisory Committee shall suggest a panel of three names for the nomination of the outside examiner for evaluation of thesis to which the Professor shall add two more names before forwarding the panel to the Dean. The Head may also, if he likes, add any names to the above panel. Where the Professor himself is the Chairman of the Advisory Committee, the Professor shall suggest three names and the Head shall suggest two more names for the panel. Similarly when the Head is the Chairman, he shall suggest the first three names and the Professor shall suggest two more names for the panel.

11.15.2 A student may offer a seminar/workshop on his thesis research problem before the submission of thesis and all the faculty members may be invited to participate in the discussions and make constructive criticism of the thesis. The provision has been prescribed more as a guideline and the actual details of implementing it shall be left to the various disciplines.

11.15.3 The candidate shall be required to complete and submit the thesis to the Professor of the discipline concerned along with "No Dues Certificate" and other formalities. The thesis then shall be forwarded by the Professor to the P.G. School without any further examination of its contents.

11.15.4 The thesis shall be submitted in an unbound form kept in a proper file. The thesis shall be reviewed in the light of the comments of the external examiner and the Examining Committee. In case the external examiner suggests modifications/re-submission of the thesis, and these are not acceptable to the student, he may be permitted to defend his thesis at the time of the final *viva-voce*, and such of the modifications as are finally agreed upon may be carried out after the viva-voce.

11.15.5 The Chairman of a student's Advisory Committee shall ensure that all members of the Advisory Committee are duly consulted before the draft thesis submitted by the student. In cases where the student's Advisory Committee has been reconstituted or Chairman changed, the student shall clearly indicate the name of the previous Chairman and the period for which he served as Chairman.

11.15.6 The thesis shall be accompanied by certificates duly endorsed by the major adviser to the effect that (a) the thesis is the result of the student's own work and (b) the contents, while being submitted for the award of the degree, have not been published, in part or in full, even in annual reports of the Institute or of schemes financed by the Indian Council of Agricultural Research, the Council of Scientific and Industrial Research etc. However, if a student and the major advisor so desire, a part of the thesis may, with the prior approval of the Dean, be published prior to submission of thesis for establishing priority.

11.15.7 Each student should submit three copies of the thesis of which one copy would eventually be deposited in the Central Library, another in the Divisional library and the third, with the major adviser. The student shall also submit with the thesis three copies of the abstract of the thesis, neatly typed (about 500 words). The abstract shall be of high quality and properly edited after perusal by the Examining Committee. The abstracts of the thesis submitted by the students should be carefully scrutinised by the Professors concerned and sent to the P.G. School for editing.

11.16 Evaluation of thesis for the award of M.Sc. degree

11.16.1 The thesis submitted in partial fulfilment of the M.Sc. degree shall be evaluated by an Examining Committee composed of the student's Advisory Committee and an additional member with the major adviser as Chairman. The additional member shall be a specialist in the student's major field of study and shall ordinarily be appointed by the Dean from a panel of three names of specialists in the particular field in India submitted to him confidentially from the discipline concerned, but outside the IARI and its sub-stations. The Dean, however, shall have the discretion to select the additional member from outside the standing panel of specialists suggested by the discipline after consulting the concerned Head of the Division, Professor and the Chairman of the Advisory Committee. The additional member shall send his report directly to the Dean.

11.16.2 In case the additional member does not recommend the thesis for the award of the degree, the Dean may on the special recommendation of the Advisory Committee refer the thesis for scrutiny and independent judgement to a second additional member chosen and appointed by the Dean either from the original panel, or from outside the original panel. If the second member recommends the thesis for acceptance, this recommendation may be accepted. If however, opinion is still not unanimous, the degree shall not be awarded.

In such cases the student shall have the option to continue the work, rewrite the thesis and submit it once again after lapse of at least one trimester, but not for a third time.

11.16.3 A final *viva-voce* shall be held by the Advisory Committee after the receipt of the full report of the additional member and after thesis is recommended by the Examining Committee for consideration. The report of the dissenting examiner if any, shall also be considered by the Examining Committee at the time of the final *viva-voce*. A notice shall be displayed on the notice board of each discipline regarding the date and time of the final *viva-voce* of each student so that interest faculty members may attend the same.

11.16.4 The degree shall be awarded on the unanimous recommendation of the Examining Committee. The Chairman shall send the recommendations of the Examining Committee to the Dean in the prescribed form (Annexure XXVIII).

11.17 Evaluation of thesis for the award of Ph.D. degree

11.17.1 The thesis submitted in partial fulfilment of the Ph.D. degree shall be read and examined by an Examining Committee appointed by the Dean and composed of the Advisory Committee and two additional members. The major adviser shall be the Chairman of the Examining Committee. The additional members shall be from outside the IARI and its sub-stations. They shall ordinarily be chosen by the Dean from a panel of at least five names of specialists in the particular field which shall be submitted to him by the concerned discipline confidentially. The Dean shall, however, have the discretion to select the additional members from outside the standing panel of such specialists suggested by the discipline, after consulting the concerned Head of the Division, Professor and the Chairman of the Advisory Committee. The Additional members shall send their reports on the thesis direct to the Dean.

11.17.2 In case the reports of both the additional members are unfavourable, the thesis shall not be considered for award of the degree. In case of only one unfavourable report, the Dean, may, on the recommendation of the Advisory Committee refer the thesis for scrutiny and independent judgement to a third additional member chosen and appointed by the Dean either from the original panel or from outside the original panel, after consulting the concerned Head of the Division, Professor and the Chairman of the Advisory Committee. If the third additional member recommends the thesis for award of the degree, this recommendation may be accepted provided at least one of the two other original additional members, who have read the thesis also agree with this recommendation, if not, the thesis shall not be considered for the award.

11.17.3 If a thesis is not accepted for award of the degree, the candidate may be permitted to continue the work by rejoining the Post Graduate School within a period not exceeding six months from the date of communication of the rejection of the thesis and submit it once again after the lapse of at least a trimester after rejoining the P.G. School.

11.17.4 After a student's thesis for the Ph.D. degree is evaluated, the thesis shall be finally accepted for the award only after the student completes satisfactorily a final *viva-voce*, which shall be conducted by the student's Advisory Committee with the addition of one of the additional members who evaluated the thesis and recommended it for the award of the degree. The *viva-voce* shall be conducted only on the basis of the full report of the examiner, and not on the basis of the intimation of the approval of the thesis. The report of the dissenting examiner, if any, shall also be considered by the Examining Committee at the time of final *viva-voce*. The *viva-voce* shall relate mainly to the thesis problem; the Examining Committee shall, however, be free to test the student in his major and minor fields of study. The candidate shall be expected to defend the thesis at the oral examination. A notice shall be displayed on the notice board of each discipline regarding the date and time of the final *viva-voce* of each student so that interested faculty members may attend the same.

11.17.5 The degree shall be awarded on the unanimous recommendation of the Examining Committee taking into consideration the merit of thesis itself and the performance of the student in the final *viva-voce*. The recommendation of the Committee shall be forwarded by the Chairman to the Dean in the prescribed form (Annexure XXII) which shall be signed by all members of the Examining Committee.

11.18 Re-examination in the case of failure in final viva-voce

11.18.1 A student who fails in the final *viva-voce* examination may apply again to the Dean with the recommendation of the Chairman of the Advisory Committee for permission to appear a second time. Permission to appear for the second time may be given but the re-examination shall not take place earlier than three months after the first examination and it will be conducted by the committee as previously constituted, as far as possible. Re-examination for third time is not permissible and a student who fails for a second time cannot continue as a student in the P.G. School and qualify for a degree from the P.G. School.

11.18.2 The particulars of the candidates who have successfully completed all the requirements shall be placed for approval before the Academic Council. After the Academic Council declares the candidates eligible for the award of the respective degrees of the Institute, a notification containing the names of the candidates so declared eligible, along with the titles of their thesis, shall be issued by the P.G. School. The actual award of the degree shall be made at the next Convocation of the Institute.

11.19 Venue of examination

No examination would be conducted outside the IARI campus without obtaining prior written permission of the Dean.

11.20 Rights regarding thesis, it publication and reference

11.20.1 The thesis submitted by a student shall become the property of the Institute and no part thereof shall be published without the prior permission of the Dean or Head of the Division who shall be regarded as exercising this power on behalf of the Dean, and there shall be no objection to the abstracts of the thesis being published in the Divisional publications. Whenever an extract from the thesis is published, a footnote shall always be given saying that the thesis had been submitted for the degree of the Post Graduate School at the Indian Agricultural Research Institute.

11.20.2 All patents, designs and inventions derived from the thesis research work shall belong to the Institute which may, at its discretion, allow or direct any benefit thereon to be retained by or given to the author of the thesis.

11.20.3 The thesis may be published in the form of an abstract/article in the publication "Abstracts of Post Graduate Students' Thesis". The student shall be the author of the article. The names of all the members of the student's Advisory Committee shall be printed as an "Inset", the name of the Chairman appearing in bolder type.

11.20.4 Copies of thesis deposited in the Institute Library or in the Divisional Libraries shall not be available for reference for a period of two years from the date of submission and shall, under no circumstances be issued on loan.

11.20.5 In case where students do not care to publish their thesis work even after many years of completion of their degree, there is no objection to the Chairman of the student taking the initiative to write a paper in consultation with the student provided the student is given first authorship and the Chairman takes credit for second authorship.

11.21 Abstracts of Post Graduate Student's thesis

11.21.1 The "Abstract of Post Graduate Students' Thesis" is intended for publication of abstracts of all the approved M.Sc. and Ph.D. theses of the Post Graduate School. Each issue of the 'Abstracts' may also carry some invited articles. The 'Abstracts' is normally published once in a year.

11.21.2 The abstract to be published (about 500 words) shall be of high quality and properly edited. This abstract shall be bound along with the final thesis.

11.21.3 All abstracts of thesis submitted by the students should be carefully scrutinised by the Professors concerned and sent to P.G. School after editing. The P.G. School shall arrange for the publication of the P.G. School Journal after getting the draft approved in a meeting of the Editorial Board.

11.21.4 The abstract shall be in the exclusive authorship of the student and he/she shall give his/her roll number, degree for which the thesis is submitted, the discipline, date and year of submission and the names of the Chairman and the members of the Advisory Committee.

11.21.5 A suitable Editorial Board shall be constituted by the Chairman of the Academic Council for bringing out the above publication.

11.21.6 The annual subscription for subscribers in India is Rs. 15/- and in other countries, 30 shillings or U.S. $4.00. These rates are subject to change as and when necessary.

12 Relief from the P.G. School

12.1 Temporary withdrawal from studies

12.1.1 Temporary withdrawal shall not be allowed in the midst of a trimester under any circumstances except those mentioned in para 12.1.2 below. The trimester during which such temporary withdrawal is taken, will however counts as a full trimester.

12.1.2 Temporary withdrawal will be allowed only on the following grounds:

(a) Illness of self to be supported by medical certificate;

(b) Death of parent/guardian or, in the case of married student, of the spouse;

(c) Temporary withdrawal should be restricted ordinarily to one trimester only, but in the case of illness of the student concerned it may, subject to medical advice, be allowed for two trimesters within the duration of the course;

(d) No temporary withdrawal will be allowed for taking up employment.

(e) This decision is effective from 27.11.79.

12.1.3 Such withdrawal shall be permitted only with the prior permission of the Dean and no *ex-post-facto* approval shall be given.

12.1.4 The request for withdrawal shall be recommended by the Chairman of the student's Advisory Committee and the Professor of the concerned discipline.

12.1.5 The withdrawal shall be permitted subject to the condition that the student shall complete the programme of studies within the maximum period prescribed for completion of studies.

12.1.6 The request shall be sent at least 15 days in advance of the proposed date of withdrawal and the decision on the request shall be communicated by the P.G. School within 10 days of the date of receipt of such request.

12.1.7 The request for temporary withdrawal from P.G. School should be accompanied by 'no dues certificates' from all concerned.

12.1.8 During the period of temporary withdrawal, the name of the student shall be kept on the rolls and as such he/she shall be liable to pay fees and other prescribed charges.

(a) The temporary withdrawal from studies under above rules 12.1.1 to 12.1.8 shall not exceed two trimesters; and

(b) no student except departmental students, shall be allowed temporary withdrawal from his/her studies if he/she has not started his/her course work.

12.2 Relief before submission of thesis

12.2.1 A student may be relieved from the P.G. School with the prior permission of the Dean for accepting employment outside or for rejoining duty in the parent department if all the requirements including research work except submission of thesis have been completed subject to the following terms and conditions:

(a) The request for relief shall be submitted in the prescribed proforma (Annexure XXIII) and shall give details of the progress of the research work, laboratory work, analysis of data and the stage of preparation of thesis.

(b) The Chairman and the Professor concerned shall certify that all the work except the submission of thesis has been completed by the student. If necessary, the Professor may request the Chairman of the student's Advisory Committee to call a special meeting of the Advisory Committee in which he (the Professor) would be present to satisfy himself about the completion of research work of the student before issuing the certificate under this rule. In case of difference of opinion, the Professor would send the proceedings of the Advisory Committee meeting alongwith his own recommendations to the Dean for a final decision by the latter.

(c) The minimum residential requirement should have been fulfilled.

(d) Application for job should have been routed through the Dean. If the application was sent prior to joining the P.G. School, the student shall inform the Dean about this application soon after admission.

(e) The student shall undertake to pay tution fee of Rs. 25/- per month from the date of relief till the date of submission of thesis so as to continue on the rolls of the P.G. School.

(f) The student shall not be entitled to hostel accommodation after relief. However, the Dean may consider the request for accommodation during the limited period, for which the student will be at IARI while actually submitting the thesis and he/she should be on leave from the employers.

(g) The student can be relieved from the P.G. School on his/her request on the completion of his/her research work pending submission of thesis with a clear stipulation that he/she should submit his/her thesis within a period of one year from the date of relief failing which his/her name shall be removed from the rolls of the P.G. School.

12.2.2 A departmental part-time student may also be relieved provided he/she has been on the rolls of the P.G. School for not less than two academic years.

12.2.3 No student shall leave the P.G. School for accepting employment outside or for any other reason, without prior permission or relief and without obtaining relieving certificates before his/her departure. The various disciplines shall not relieve the students without the permission of the Dean.

12.3 Relief after submission of thesis

12.3.1 A student shall be relieved, with the prior permission of the Dean, from the P.G. School at his/her own request after the submission of thesis for accepting employment or for any other purpose.

12.3.2 The name of the student shall remain on the rolls of the P.G. School till the date of completion of the final *viva-voce*.

13 Convocation and Award of Degrees

13.1 Award of degrees

13.1.1 A convocation shall be held for conferring M.Sc. and Ph.D. degrees to the successful candidates declared eligible for the award of the degree by the Academic Council. The programme of the Convocation shall be approved by the Academic Council.

13.1.2 Every successful candidate shall appear in person at the Convocation to receive the degree. However, if a candidate does not appear in person, the degree shall be conferred *in absentia*. The fee for concerning a degree *in absentia* shall be Rs. 25/-. The degree certificates in such cases will be sent to their notified addresses on payment of the prescribed fee.

13.1.3 In order to be eligible for obtaining the degree in a particular Convocation, the student shall submit the thesis at least two months in advance of the date of Convocation or a date to be notified from time to time.

13.1.4 The degree may be awarded posthumously to a student if he had completed all the requirements for the award of degree including the final *viva-voce* examination, before his/her death.

13.2 Duplicate degrees and certificates

Issue of duplicate degrees and other certificates shall be governed by the following guidelines:

(a) A request for duplicate degree/diploma/certificate shall be granted only on the production of an affidavit on a stamp paper of Rs. 2/- to the effect that applicant has lost the degree/diploma/certificate issued earlier or that it has been destroyed and the applicant is in real need of it.

(b) A fee of Rs. 20/- shall be charged for the issue of a duplicate certificate.

(c) The word "duplicate" shall be inscribed in bold letters at the top of such degree/diploma/certificate.

(d) The duplicate degree/diploma/certificate shall be signed by the Registrar (Academic), P.G. School and the words "Sd/-" along with the names of the original signatories shall be inscribed in the appropriate places.

13.3 Award of honorary degrees

13.3.1 The Academic Council of the Institute may confer degrees of Doctorate of Science (*Honoris Causa*) on persons who have distinguished themselves in the field of science but are not either serving staff members of the I.A.R.I. or serving members of the A.R.S. of the I.C.A.R.

13.3.2 All proposals for conferment of honorary degrees shall be received and processed by the office of the Dean, P.G. School at the Institute.

13.3.3 The Dean shall cause all such requests, with necessary background information, to be placed for consideration before a Special Committee consisting of the following:

(i) Dean, P.G. School	Chairman (Ex-Officio)
(ii) Dy. Director-General (Edn.), I.C.A.R.	Member (Ex-Officio)
(iii) One representative of each of the 5 Schools namely the School of Crop Production; Crop Protection; Crop Improvement; Crop physiology & Biochemistry; and Social Sciences (to be nominated by the Chairman, Academic Council)	Member
(iv) One external scientist member of the Academic Council (to be nominated by the Chairman, Academic Council)	Member
(v) Registrar (Academic)	Member-Secretary (Ex-Officio)

The Committee shall consider with all convenient despatch the proposal(s) for conferment of honorary degree(s) referred to it and make its recommendations thereon to the Academic Council.

13.3.4 The Dean shall cause the recommendations of the aforesaid Special Committee to be placed before the Academic Council for consideration. The decision to confer an honorary degree shall require 2/3 majority of the members present and voting in the meeting of the Academic Council.

13.3.5 After approval of the Academic Council, the Dean shall issue a notification and take the necessary steps for the award of the degree. The degree may be awarded at the annual convocation or if necessary by holding of a special convocation.

14 Rules of the Institute Library

14.1 Normal working days and hours

14.1.1 The library shall remain open on all working days in Summer (Apr-Sept.) from 8.30 am to 9 pm and in Winter (Oct-Mar) from 8.30 am to 8.30 pm. Stack rooms shall be closed one hour before the closing time of the library.

14.1.2 On Sundays, Second Saturdays and other gazetted holidays except for those mentioned in para 14.1.4 below, the reading rooms alone, shall be kept open from 9 am to 1.00 pm in Summer as well as in Winter.

14.1.3 Issue counter for loan and return of books and serials shall remain open only from 8.30 am to 8.00 pm in winter and in summer from 8.30 am to 8.30 pm on all working days. Overnight loan of text books to students shall be issued only from 7 pm till 15 minutes before closing time of the library on working days and from 12.30 pm to 1 pm in holidays.

14.1.4 The library shall remain completely closed on 26th January (Republic Day), 15th August (Independence Day), 2nd October (Mahatma Gandhi's birthday) and on the day of 'Holi' festival.

14.2 Do's and don'ts of the Library

14.2.1 Publications taken out on loan are subject to check by the person on duty at the entrance gate.

14.2.2 All personal belongings such as umbrellas, hats, walking sticks, books and files, briefcase and hand bags etc., shall be kept near the counter at a place provided for the purpose. Only loose sheets, cards and note books shall be allowed to be brought inside the library.

14.2.3 Smoking is strictly prohibited in the reading rooms and in the stack rooms.

14.2.4 No one shall remove any publication out side the library except in accordance with the rules regulating the issues of publications on loan.

14.2.5 No other objects belongings to the library shall be removed out of its premises except with the written permission of the Head Library Services.

14.2.6 No one shall, whether for the purpose of correcting an error or otherwise, make any markings whatsoever in publications belonging to the library, underline words and sentences therein, dog-ear pages or otherwise damage or mutilate them in any manner.

14.3 Loss and damage of publications

14.3.1 If any publication is lost or disfigured or if any page and picture is removed by the reader, he/she must replace it by a new copy or by a photocopy on the discretion of library authorities. If he/she fails to do so, he/she shall be required to pay the cost plus any fine that may be levied by the authorities.

14.3.2 The borrowers shall examine the books and periodicals at the time of receiving them. When detected, the last borrower shall be held responsible for any damage, mentioned in rule (14.2.6).

14.4 Members and users of the library

14.4.1 All bona fide research workers and regular students of this Institute shall be eligible to become members of the library.

14.4.2 All the research workers and technical staff (upto the level of T-I) shall be eligible to get books on loan.

14.4.3 Honorary research workers, research fellows and students shall be eligible to get books on loan either on their making the prescribed deposit and fulfilling other formalities with the cashier of the Institute or the recommending Head of the Division shall take the responsibility for obtaining no due certificate from the library at the time of his/her leaving the Institute.

14.4.4 All bona fide members of the library shall be provided with the prescribed library tickets for borrowing publications.

14.4.5 The Library ticket holders shall be exclusively responsible for loss of the ticket and for its misuse by others. In case of loss of the ticket the holders shall report the matter to the library and apply for its replacement after depositing Rs. 5.00 per ticket.

14.4.6 Research staff, students and research fellows shall be issued 5 readers tickets and technical staff in category-III, II & I will respectively get five, three and one readers tickets.

14.4.7 Bona fide Research workers belonging to other organisations shall be given only consultation facilities on their applying through the Head of the respective organisations.

14.4.8 Bona fide scientists and research workers of other Institutes/organisations shall be enrolled as special members of the library for getting books on loan subject to the conditions that (1) the membership application is forwarded by the Head of the respective institute/organisation, (2) deposit Rs. 500/- as security money with the cashier of the Institute and (3) two permanent staff members of IARI equivalent to gazetted rank shall stand surety for the applicant. The person thus enrolled shall be entitled for loan of only one publication at a time.

14.5 Loan and late fee

14.5.1 Publications shall be issued only against the library readers ticket.

14.5.2 One publication shall be issued against one readers ticket.

14.5.3 Faculty members and students shall get one book on loan for teaching purpose and consultation from Text Book Section for three months and overnight loan respectively.

14.5.4 Books taken out on loan shall be retained for a maximum period of 14 days only but these liable to be recalled at any time. After due date a late fee of 25 paise shall be charged per day per book.

14.5.5 Serials (periodicals, annual reports and bulletins) taken out on loan shall be retained for a maximum of two days only but these are liable to be recalled at any time. After the due date, a late fee of 25 paise shall be charged per day per publication in the first week and Rs. 1/- per day per publication thereafter.

14.5.6 The late fee amount in cash shall be collected at the counter. A borrower shall not be allowed to borrow books again unless late fee assessed has been paid.

14.5.7 Text books reserved for Post Graduate students for overnight loan shall be issued after 7 p.m. on working days and 12.30 p.m. on holidays. These must be returned the following day within the first hour of opening the library. Failure to return the book taken on loan within the time prescribed above shall subject the students to a fine of 50 paise. In case it is kept by the students for the second night, the fine shall be Rs. 1/- for each succeeding day or fraction thereof. This rule shall be rigidly enforced. Persistent abuse of these privileges will attract disciplinary action.

14.5.8 Faculty members shall be entitled to borrow one book at a time from Text Book Section for three months for teaching purposes provided the book has more than one copy in the section. Books kept in any other section shall be available for 14 days and serials for 2 days at a time according to rules 14.5.4 & 14.5.5.

14.5.9 All loan requisitions for books and serials shall be addressed to the Head Library Services.

14.5.10 Transfer of books is strictly prohibited.

14.5.11 Local borrowers shall not be permitted to take books out of station except with the prior permission of the Director.

14.5.12 Books from the Divisional libraries shall not ordinarily be available for loan to those outside the Division except with the special permission of the Head of the Division concerned.

14.5.13 Publications under the following categories shall not be issued on loan (i) Reference publications such as dictionaries, encyclopaedias, handbooks, yearbooks, atlases, maps and gazetteers; abstracting and indexing journals, annuals and theses and publications stamped as 'Reference', (ii) publications in damaged and dilapidated condition and (iii) Loose issues of serials, (iv) publications kept in closed sequence and such other books as have gone out of print or are not easily replaceable.

14.5.14 Publications more than 20 years old and unbound issues of periodicals shall not be issued on loan except at the discretion of the Head Library Services under special circumstances.

14.5.15 Subject to the rules as above, publications excepting those issued by the Institute and Indian Council of Agricultural Research, may by permission of the Head Library Services be loaned to the bona fide research workers under the central and state governments, universities and other institutions on their sending requisitions through their respective librarians/Head of Offices. All such requisitions shall be addressed to the Head Library Services, IARI, New Delhi-110 012.

14.5.16 Outside borrowers shall have to bear the transit and packing charges both ways. The borrower shall have to remit postal and packing charges in advance. The packing charges shall be calculated @ 12% of the cost of postage.

14.5.17 An infringement of the above rules shall render the defaulter liable to be deprived of the privileges of using the library or to such other disciplinary measures as may be determined by the Director, IARI.

15 Residence in the Student Hostels

15.1 General

15.1.1 There are six hostels for the residence of post-graduate students, Vasant Hemant and Shishir are for male students; Sharad and Saraswati hostels are earmarked for married students, allotment of which is made as per rules in para 15.4 and Mandakini are exclusively earmarked for female students. The general management of hostels is vested in the Master of Halls of Residences, under the overall supervision and guidance of the Dean. The Master of Halls of Residences is assisted by four Associate Wardens, One Asstt. Warden including a lady Associate Warden and also by student prefects. The rules for residence in the hostels are given in the succeeding paragraphs. 'Hostel' would mean any residential accommodation provided by the IARI to a student on rolls, including Married Students' Apartments.

15.1.2 (i) Residence in Hostels, subject to availability of accommodation, is compulsory for all students of the P.G. School. Except in the case of married lady students, no exemption from compulsory residence in the P.G. Hostels shall ordinarily be given to other students. The departmental candidates will be eligible for hostel accommodation provided they have not been allotted IARI accommodation or do not have their own houses in Delhi in his/her own name or that of his/her spouse.

(ii) Without prejudice to the generality of the foregoing clause (i), the following principles shall be adopted in making allotment of the available accommodation to the P.G. students:

(a) Such of the students as are local residents shall be provided accommodation in the students' Hostel unless all those coming from outside Delhi have been provided accommodation at the prescribed scale in the Hostels meant for them;

(b) After the students coming from outside have all been accommodated in the Hostel(s) meant for them, local residents may subject to availability be alloted accommodation as per the following criteria:

(i) Those admitted in an earlier year shall be treated as senior to those admitted in a later year;

(ii) Amongst those admitted in the same year, those living at a more distant place (ordinarily as per the address declared in their applications for admission) from the campus, shall receive preference. Regarding any question as to the relative distance of two or more places from the Campus, the Dean's decision shall be final;

(iii) The Dean may, in exceptional cases and for reasons to be recorded allot hostel accommodation to any student in relaxation of these principles. All such cases shall be reported to the Standing Committee on Student's Welfare, Board & Residence.

15.1.3 The students residing in the hostels shall be required to abide by the current hostel rules and other instructions issued by the hostel authorities from time to time. Any breach of hostel rules and of such instructions will render a student liable to disciplinary action.

15.1.4 On admission, each student shall deposit in the P.G. School Office the prescribed caution money for residence in the hostel. The allotment of rooms shall be made by the Master of Halls of Residences on receipt of memorandum of admission from the Dean's Office. No change of rooms shall be allowed without prior permission of the Master of Halls of Residences.

15.1.5 Students shall be required to check the furniture, fixtures etc. provided in the rooms allotted to them. They shall make proper acknowledgement of receipt of these articles by signing in a prescribed inventory maintained in the hostel office and shall be responsible for their safe custody. No item of furniture or any part thereof shall be moved from one room to another or from one part of the hostel to the other without the written permission of the Master of Halls of Residences.

15.2 Attendance

15.2.1 The gates of the hostels shall be closed at 10.30 P.M. during summer and 10.00 P.M. during winter, and will be opened at 5.00 A.M.

15.2.2 Students shall not remain absent from their rooms after 10.00 P.M. in winter and 10.30 P.M. in summer without prior permission of the Master of Halls of Residences. Late comers shall be required to sign in a separate register maintained for the purpose.

15.2.3 A student who wants to remain away from the hostel throughout the night or for a few days should inform in writing to the Master of Halls of Residences about such absence in the prescribed slips to be supplied by the hostel office for this purpose. Students remaining absent without intimation shall be doing so at their own risk and the Institute authorities shall have no responsibility for such absence.

15.3 Leave of absence

15.3.1 For leave of absence from hostels, students shall obtain prior permission of the Master of Halls of Residences, and the prescribed application forms for this purpose can be had from the hostel office during working hours.

15.3.2 In the case of a student remaining absent from the hostel without prior permission, the hostel authorities may open such rooms and get them vacated after preparing an inventory of the articles found in the room. However, no claims for the loss or damage to these articles shall be entertained.

15.4 Rules for married students' hostel (Sharad hostel and Saraswati apartment)

15.4.1 Allottees of married students' apartments shall be governed by the additional terms and conditions mentioned in paragraphs 15.4.2 to 15.4.21.

15.4.2 A. Married Foreign Students:

i) Where both husband and wife are IARI students.

ii) Where either husband or wife is IARI student.

B. Ph.D. married students who have completed comprehensive qualifying examination.

i) Lady married students with children but without spouse;

ii) Others.

15.4.3 The allotment of Apartment shall be made for one year and a half in the first instance and shall be extendable for another four months on the valid ground on written request from the student. The request for extension shall be made at least one month before the date of expiry of allotment.

15.4.4 The allotment shall stand automatically cancelled after 15 days of submission of thesis or taking temporary relief in case of thesis not submitted (applicable to both Saraswati Apartment and Sharad Hostel).

15.4.5 The allotment shall also stand cancelled if the family is away from the Apartment for more than 45 days (3 months in case of maternity).

15.4.6 Before allotment of married students hostel, the student(s) shall furnish a Marriage Certificate alongwith joint photograph of both husband and wife.

15.4.7 No allotment shall be made if spouse is employed. In case where the spouse is staying outside Delhi the accommodation shall not be allotted.

15.4.8 The above condition (para 154.7) will not, however, affect allotment as per clause No. 15.4.2 (B) (i) above.

15.4.9 The above guidelines shall apply to all married students (including those at IASRI) of the P.G. School. In order to check unauthorised stay in the Sharad and Saraswati Hostels, Rs. 30/- per day should be charged from a student for overstayal for first thirty days, and thereafter Rs. 75/- per day should be charged for subsequent 30 days. As regards Sharad hostel the overstayal charges beyond the prescribed period under rules shall be Rs. 20/- per day for first 30 days in Saraswati Hostal. and Rs. 50/- per days for the next 30 days. The students should not be allowed to stay in the Hostels beyond the prescribed limit of 60 days as indicated above in any case.

15.4.10 For the purpose of allotment, a married student's family shall consist of only self, spouse and child(ren), if any.

15.4.11 Married students apartment shall not be allotted to a married student whose spouse does not ordinarily stay with the student. The Dean will satisfy himself on the need and his decision will be the final. However, a female married student having child(ren) to stay with her shall be eligible for allotment.

15.4.12 An M.Sc. student has to vacate the apartment at the end of the M.Sc. programme even if he/she secures admission at the P.G. School for Ph.D. Such students in the event of admission to Ph.D. will be issued enrolment card only when they surrender the existing accommodation provided to them.

15.4.13 An allottee shall have to occupy the apartment within 15 days of the issue of the allotment offer. He/She will, however, be required to intimate the date on which he/she would occupy the apartment. The apartment will be made available only when he/she brings the family. The details of the family (name, age, sex and relation) would be required to be furnished by each allottee.

15.4.14 If a married student has already been allotted accommodation in one married students hostel normally a change to the other hostel shall not be permitted save in exceptional circumstances to be decided by the Dean on the recommendation of the Master of Halls of Residences.

15.4.15 On allotment of married students apartment, the student shall have to vacate single seated room, if in possession, within 3 days of the occupation of married students apartment failing which allotment of the married students apartment shall automatically be stand cancelled.

15.4.16 In the event of relief from P.G. School the students shall vacate the apartment and produce documentary evidence thereof to the P.G. School before relief orders are issued by the PG School.

15.4.17 The allotment of apartments shall be made for one year and six months in the first instance which shall be extendable subject to availability of accommodation for another 4 months on valid ground and on written request from the student.·The request for extension shall be made at least one month before the date of expiry of allotment. Normally no extension shall be given beyond this period except in very exceptional cases to be decided by the Master of Halls of Residences strictly on academic consideration and even then the further period of extension should not exceed two months in any case. An M.Sc. student has to vacate the apartment at the end of the studies, even if he/she secures admission at the P.G. School for Ph.D.

15.4.18 The allotment of the apartment shall be considered on the basis of the year of admission and in case of tie, the allotment shall be made by drawal of lots. On allotment, the students shall surrender their existing hostel accommodation, if any.

15.4.19 If a student's family is sent out of Delhi for more than 45 days, the apartment shall be surrendered and the student should take the accommodation in the other hostel. For retaining the apartment for 45 days during absence of the family, the occupants shall obtain prior permission from the Master of Halls of Residences.

15.4.20 *Charges* : The charges for the rooms in Sharad Hostel inclusive of water and electricity shall be Rs. 75/- per month. This is subject to periodical review and revision. The charges shall be deposited in the Syndicate Bank, Pusa Branch by the 10th of every calendar month and the receipt to be shown to the P.G. Hostel Office for record.

15.4.21 *Charges for the Saraswati apartment will be as under:*

(i) Rs. 115/- inclusive of Rs. 10/- as flat rate of water charges + Rs. 30.00 as electricity charges until such time the electric sub meters are provided.

(ii) Rs. 85/- per month inclusive of Rs. 10/- as flat rate of water charges + actual cost of consumption of electricity (this will be applicable when the electric sub meter has been provided).

15.4.22 *Guests* : Guests of students (Families) can be accommodated in specific guest rooms earmarked in Shishir Hostel, Sharad Hostel and Mandakini Hostel for this purpose, on payment as detailed below:

Name of Hostel	No. of Guest Rooms	Charges
1. Vasant Hostel	5 rooms (10 beds-two in each)	Rs. 5/- per day for each bed.
2. Sharad Hostel (for families)	5 rooms (10 beds-two beds in each)	Rs. 10/- per day for two beds.
3. Mandakini Hostel (for girls)	5 rooms with one bed in each	Rs. 5/- per day for each bed.

The charges for the above stay by the guests in the Guest Rooms beyond the prescribed period of 10 days will be as under:

1. Vasant Hostel — Rs. 25/- per day for each bed.
2. Sharad Hostel — Rs. 50/- per day for two beds.
3. Mandakini Hostel — Rs. 25/- per day for each bed.

(a) Normally no guest shall be allowed to stay for more than 10 days, but in exceptional/unavoidable circumstances they can be allowed to stay for one or two days beyond 10 days by the MOHR at the higher rates as detailed above, after consideration on merit. However, such requests will be entertained subject to the availability of Guest Rooms.

(b) The same guest cannot be allowed to stay for more than 10 days as guest of some other student.

15.4.23 *Furniture* : Each student shall be provided with two cots, two chairs, one table, one book rack and one gas burner with cylinder. Payment for gas shall be made by individual student. If extra items of furniture are needed, the permission of Master of Halls of Residences shall be taken and a nominal hire charge of Rs. 2/- per month per item shall be levied for such purpose.

15.4.24 *Cooking and washing* :

(a) Cooking shall be done on gas burners only.

(b) Washing of utensils and crockery shall be done only in bathroom.

15.4.25 *Possession and use of electrical appliances* : No allottee shall possess or use any electrical appliances like heater, cooking range, immersion rods etc. in the rooms. Violation of this rule shall result in a fine of Rs. 100/-, forfeiture of the appliances and cancellation of allotment.

15.4.26 The allotment of the apartments in the Sharad and Saraswati hostel (married students' apartments) is liable to be cancelled if the students do not comply with the terms and conditions of allotment.

15.4.27 The departmental students coming to headquarters from Regional Station/Sub-station of IARI for doing M.Sc./Ph.D. at this Institute shall be eligible for hostel accommodation. These students would be required to pay licence fee and also tution fee for the period they continue to occupy the hostel accommodation.

15.5 Vacation of rooms in the hostel

15.5.1 No student is normally allowed to stay in the Hostel during the summer vacation without the prior permission of the Master of Halls of Residences. Students desirous of staying in the Hostel during summer vacation shall pay a consolidated charges of Rs. 34.00 (subject to revision) for the duration of the vacation in the first week of April and produce the receipt in the Hostel Office for record. The Hostel Office will send to P.G. School consolidated list of students who have not paid summer vacation charges in the last week of April. Students staying in Sharad and Saraswati Hostel will pay Rs. 50/- per month during summer vacation (subject to revision).

15.5.2 Students leaving the hostel on long leave of summer vacation or proceeding to any sub-station for training must hand over the charge of their rooms to the hostel office.

15.5.3 The students who have submitted their thesis may be permitted to retain hostel accommodation upto three months after the date of submission of thesis or upto seven days (15 days in case of foreign students) from the date of final viva-voce whichever is earlier on payment of water and electricity charges @ Rs. 17/- per month (subject to revision) subject to availability of hostel accommodation and provided they actually reside in the hostel. They shall not be allowed to continue in the hostel after they are relieved of studentship from the Dean's office or if their names are struck off from the rolls by the Dean. Students desirous of staying in the hostel even after seven days of the completion of their viva-voce shall be permitted to stay as guests for not more than 15 days.

15.5.4 While finally vacating the hostel each student must hand over the charge of the room and all hostel properties issued to him/her to the Caretaker/Assistant Caretaker and obtain a no dues certificate to the effect from the Master of Halls of Residences.

15.5.5 (1) Unless otherwise specially authorised by the Dean in any case, the allotment of hostel accommodation to a student/ex-student, as the case may be, shall stand cancelled in the following events:

(a) On expiry of a period of three months from the date of submission of thesis or seven days (15 days in the case of foreign students) from the date of holding of final viva-voce examination, whichever is earlier.

15.5.10 Women are not allowed in the hostel rooms occupied by men and men are not allowed in the rooms occupied by the women. Such visitors (women/men) may, however, be received in the visitors room or reception room ear-marked separately in each hostel. The Hostel Attendant shall call for the persons whom the visitor wishes to meet to the visitor's room itself. In the case of ladies hostels, men are not permitted to visit between 10.00 PM and 8.00 AM. A Register may be maintained at the gate of each hostel and necessary entries relating to guests shall be made in this register. The Hostel Attendant shall be strictly instructed to enforce these rules. Any departure from these rules shall require prior approval of the Master of Halls of Residences. Any violation of these rules shall result in disciplinary action on the student(s) concerned.

Note: Lady guests should not normally be allowed to enter common rooms and Dining Hall of Boys Hostel and if any student wants to invite lady guests for lunch or dinner, prior permission of the Master of Halls of Residences should be obtained by him.

15.6 Electricity

15.6.1 Students are required to make their own arrangement for electric bulbs for their rooms. Use or possession of electric heaters or other electric appliances in the hostel rooms is not permitted. A fine of Rs. 100/- shall be levied, the appliance confiscated for violation of this rule and cancellation of allotment.

15.6.2 Fans and lights in the rooms must be switched off before leaving the rooms.

15.7 Bicycle

15.7.1 Students shall be issued numbered tokens corresponding to their room number and no student shall be allowed to take out his/her bicycle without presenting the token at the gate. A limited supply of tokens for guests shall also be maintained and issued to bonafide guests.

15.7.2 Riding of bicycles, Scooter/Motor cycles in the corridors of the hostels is forbidden. Breach of this regulation shall render the offender liable to disciplinary action.

15.7.3 All bicycles shall be kept properly locked. The watchmen on duty are instructed to take possession of unlocked bicycles, which shall be released only with the permission of the Master of Halls of Residences.

15.8 Telephones

15.8.1 Telephones are provided in each hostel for making local calls only during specified hours which shall be notified by the Master of Halls of Residences from time to time. The use of telephone for making trunk calls is not usually permitted.

15.8.2 Students wishing to make local telephone call would be required to pay the prescribed local charges to the attendants on duty. Coupons shall be available with the telephone attendants against payment.

(b) On removal of name, or on relief, from the P.G. School.

(c) On expiry of the period of allotment or extended allotment of hostel accommodation in Married Students Hostel (i.e. Sharad Hostel and Saraswati Apartment) as prescribed in rule 15.4.17.

(d) On proceeding on leave or training to a sub-station for a period exceeding one month.

(e) On the Dean's permission being granted to vacate hostel accommodation on his/her request.

(2) A student/ex-student, as the case may be, whose allotment of hostel accommodation gets cancelled, in any of the circumstances mentioned in clauses (a) to (c) of the preceding sub-paragraph (1) shall be liable to pay a fine of Rs. 30/- per day for the first thirty days and thereafter Rs. 75/- per day for subsequent 30 days if the room is located in the Saraswati Apartment, Rs. 20/- per day for first 30 days and Rs. 50/- per day for the next 30 days in case the room is located in Sharad Hostel, and Rs. 10/- per day, if the room is located in any other P.G. Hostel, from the date of such cancellation of allotment, till the date on which he/she hands over, or causes the handing over of the charge of hostel room and the hostel properties issued to him/her in the manner prescribed in rule 15.5.4 or on his/her failure to do so till the date of recovery of possession by other means.

(3) An ex-student, who after appearing at the final viva-voce examination has been allowed to stay as a guest under rule 15.5.3, shall pay room charges (inclusive of water and electricity charges) @ Rs. 10/- per day, if staying in the Sharad Hostel, and @ Rs. 5/- per day if staying in any other P.G. Students Hostels, for the period of such guest-ship which shall not exceed 15 days.

(4) If a student retains possession of the hostel room without authorisation by the Master of Halls of Residences during the summer vacation or while proceeding on leave or to a sub-station for training, he/she shall be liable to pay a fine of Rs. 3/- per day for the entire period of such violation. The fine for unauthorised retention of room in Sharad Hostel beyond 45 days in the circumstances mentioned in rule 15.4.19 shall be Rs. 6/- per day.

(5) In case of violatiion of hostel rules the matter will be referred to the Hotel Disciplinary Committee which will be constituted in each case by the Dean. In this Committee, the M.O.H.R. and Registrar (Academic) will be permanent members and two senior faculty members will be nominated as Chairman and another member. The Committee shall submit the report to the Dean.

15.5.6 If a student/former student whose allotment of hostel accommodation gets cancelled in any of the circumstances mentioned in para 15.5.5 fails to vacate the hostel room and return the hostel property in his/her possession within 48 hours of such cancellation, the Master of Halls of Residences (notwithstanding the provision for the payment of overstayal charges by the student/ex-student) may at any time thereafter take appropriate steps with the help of the Hostel/Security staff and the Police, where necessary, to open the Hostel room and get it vacated after preparing an inventory of the articles found in the room or take such other steps as he may deem necessary to recover the possession of the hostel room and the hostel property from him/her.

15.5.7 If in the opinion of the Dean, circumstances exist in which he considers that the stay of any student or students in the Hostel is not desirable in public interest, he may without assigning any reasons cancel the allotment of hostel accommodation of such student/students, and require the student(s) concerned to vacate the hostel forthwith and it shall be incumbent upon the student(s) concerned in such an event to hand over vacant possession of the hostel room and return the hostel property on the same day or within such period of time as may have been specifically mentioned in the Dean's order. Any violation of such orders, apart from attracting the imposition of the over-stayal charges at the rates prescribed in para 15.5.5(2) shall constitute misconduct on the part of such student(s) and render him/them liable to disciplinary action. The Dean may further cause the recovery of the possession of the room(s) concerned together with the articles of hostel property issued to/in the possession of such student(s) in the manner prescribed in para 15.5.6.

15.5.8 A student, aggrieved by the cancellation of his allotment and the consequential liability of payment of overstayal charges disciplinary action under para 15.5.5, 15.5.6 and 15.5.7 supra may prefer an appeal to Chairman of the Academic Council. However, the filing of an appeal shall not unless the Chairman of the Academic Council specifically orders otherwise, imply the stayal of the orders appealed against, not *per se* absolve the appellant (s) from the penal consequences thereof before or after the disposal of such appeal.

15.5.9 The following further guidelines shall be observed regarding the allotment of hostel accommodation to guests:

(a) First preference shall be given to bonafide guests sponsored by students and participants of short-term training programme organised by this Institute; person officially sponsored by other sister associations/universities shall be given the next preference. No allotment shall normally be made to persons who come unannounced and seek accommodation at the eleventh hour, and they should be politely told to seek accommodation elsewhere. As far as possible only those who have prior reservations shall be admitted to the hostels.

(b) As far as possible, the students who seek accommodation for guests arriving late in the night, shall collect the keys in advance from the hostel office after payment so that the guest can collect the keys from the students concerned on arrival. The students concerned are, however, responsible to get the required entires made by the guest in the guest register maintained in the hostel office.

(c) No guests shall be admitted normally between 10 PM and 7 AM, unless there is prior intimation about their arrival.

(d) A uniform pattern shall be followed by fixing the check-in and check-out time at 12 noon. Room charges will be levied from 12 noon to 12 noon on the following day.

(e) Non-Indian guests shall be required to furnish information regarding their nationality, passport number, period of stay in India etc.

(f) The guests should furnish clearly all the relevant information prescribed in the guest register.

15.5.10 Women are not allowed in the hostel rooms occupied by men and men are not allowed in the rooms occupied by the women. Such visitors (women/men) may, however, be received in the visitors room or reception room ear-marked separately in each hostel. The Hostel Attendant shall call for the persons whom the visitor wishes to meet to the visitor's room itself. In the case of ladies hostels, men are not permitted to visit between 10.00 PM and 8.00 AM. A Register may be maintained at the gate of each hostel and necessary entries relating to guests shall be made in this register. The Hostel Attendant shall be strictly instructed to enforce these rules. Any departure from these rules shall require prior approval of the Master of Halls of Residences. Any violation of these rules shall result in disciplinary action on the student(s) concerned.

Note: Lady guests should not normally be allowed to enter common rooms and Dining Hall of Boys Hostel and if any student wants to invite lady guests for lunch or dinner, prior permission of the Master of Halls of Residences should be obtained by him.

15.6 Electricity

15.6.1 Students are required to make their own arrangement for electric bulbs for their rooms. Use or possession of electric heaters or other electric appliances in the hostel rooms is not permitted. A fine of Rs. 100/- shall be levied, the appliance confiscated for violation of this rule and cancellation of allotment.

15.6.2 Fans and lights in the rooms must be switched off before leaving the rooms.

15.7 Bicycle

15.7.1 Students shall be issued numbered tokens corresponding to their room number and no student shall be allowed to take out his/her bicycle without presenting the token at the gate. A limited supply of tokens for guests shall also be maintained and issued to bonafide guests.

15.7.2 Riding of bicycles, Scooter/Motor cycles in the corridors of the hostels is forbidden. Breach of this regulation shall render the offender liable to disciplinary action.

15.7.3 All bicycles shall be kept properly locked. The watchmen on duty are instructed to take possession of unlocked bicycles, which shall be released only with the permission of the Master of Halls of Residences.

15.8 Telephones

15.8.1 Telephones are provided in each hostel for making local calls only during specified hours which shall be notified by the Master of Halls of Residences from time to time. The use of telephone for making trunk calls is not usually permitted.

15.8.2 Students wishing to make local telephone call would be required to pay the prescribed local charges to the attendants on duty. Coupons shall be available with the telephone attendants against payment.

15.9 Common room

15.9.1 Hostel common rooms shall remain open from 6.00 AM to 11.00 PM.

15.9.2 Furniture and other articles from the common rooms shall not be removed under any circumstances.

15.10 Boarding arrangements

15.10.1 The norms and guidelines for boarding arrangements are indicated in Annexure XXIV.

15.10.2 Cooking in rooms is prohibited except in the married student's hostel. Defaulters shall be fined Rs. 100/-.

15.11 Miscellaneous

15.11.1 Notices for the guidance of the students shall be displayed on the hostel boards. Students are advised in their own interest to read the notices regularly; ignorance of regulations and instructions shall not be an excuse for non-compliance.

15.11.2 No club or society shall be formed and no meeting, except those of the Student's Union and the Mess Committee, shall be held in the hostels nor shall outsiders be invited to such meetings without the permission of the Master of Halls of Residences/ Director. Facilities of the Institute and campus will not be available for meetings not approved by the Master of Halls of Residences/Director.

15.11.3 Parties or entertainments shall not be held in the hotels premises without the permission of the Master of Halls of Residences.

15.11.4 No dogs or other pets or fire arms or radios (other than battery operated transistor radios) are permitted to be kept in the rooms.

15.11.5 The students shall keep their rooms clean and tidy. Strict cleanliness must also be observed in bathrooms, kitchen, common rooms and dining rooms.

15.11.6 Possession or consumption of liquor and alcoholic drinks within the hostel premises is strictly prohibited.

15.11.7 All cases of illness must be reported immediately to the Associate Wardens/ Assistant Wardens/Caretaker/Assistant Caretakers. In case of serious illness the Master of Halls of Residences must be informed at once.

15.11.8 Students must not incur any debts. The hostel authorities shall not be responsible for any debts or dues to hostel messes, canteens etc., incurred by the student.

16 Co-curricular and Extra-curricular Activities and Students Welfare

16.1 Sports, recreation and cultural activities

16.1.1 The Post Graduate School encourages co-curricular and extracurricular activities outside the classroom that enrich the cultural, physical and social life of the students.

16.1.2 Spacious playgrounds are provided near the students' hostels and necessary facilities exist for various outdoor games and athletic events. There are facilities also for indoor games in each hostel.

16.1.3 There is a Students' Sports Fund to which every student subscribes at the beginning of each year a sum of Rs. 25. Besides the students also subscribe annually Rs. 10 as PGSS Union Magazine fee. The amounts so collected are used for improving sports facilities and promoting literary activities amongst the students including the publication of the students Magazine namely 'A Glimpse' and 'Greenpath'. These funds are administered by the Sports Fund Committee consisting of the following :

Master of Halls of Residences	Chairman
Honorary Sports Adviser	Member
President, PGSSU	Member
Literary Secretary, PGSSU	Member
Ladies Students' Adviser	Member
Registrar (Academic)	Member
Assistant Warden	Member
Sports Secretary, PGSSU	Member-Secretary

The accounts and records of this Committee will be maintained by the Assistant Warden, (P.G. Hostel Office) and the accounts of the fund would be audited by a nominee of the Chief Finance and Accounts Officer of the Directorate.

The students are given a very wide latitude for expressing themselves in the aforesaid magazines.

16.2 Matching grant

A matching grant of Rs. 5,000 per year will be made available for sports, cultural and literary activities of the students to the Master of Halls of Residences.

16.3 Post Graduate School Students' Union

All students admitted to the Post Graduate School automatically become members of the Post Graduate School Students' Union. A copy of the Constitution of the Union is given in Annexure XXV.

16.4 Health

A qualified Medical Officer-in-charge of the Institute's Dispensary looks after the health of the students. The Medical Officer resides in the Institute's campus and is thus available not only during the day, but in times of emergency during the night as well. The medical service is provided free to all students.

16.5 Students' welfare fund

With a view to rendering financial aid to students in distress and to support any other students' activity, a Student's Welfare Fund has been instituted. All students are required to contribute Rs. 10 each year to the Fund. Details regarding the fund are given in Annexure XXVI.

16.6 Lady students' adviser

An honorary "Lady Students' Adviser" is nominated by the Dean to look after the welfare and needs of lady students.

16.7 Foreign students' adviser

An honorary "Foreign Students' Adviser" is nominated by the Dean to look after the special problems of foreign students including general advisement regarding P.G.School procedures, and social and cultural life. A Hospitality Committee functions under the Chairmanship of the Foreign Students' Adviser to look after the comfort of foreign students.

17 Short-term Training Courses

17.1 Besides the regular post-graduate courses leading to the award of M.Sc. and Ph.D. degree, the Institute also offers facilities for refresher courses and short-term training courses in specific specialised subjects in agriculture for the benefit of agricultural scientists and extension workers coming from State Departments, research and educational institutions, and other official and autonomous organisations.

Note: Ordinarily requests for providing training to undergraduate students of other institutions at the IARI are not accepted.

17.2 A roster of short-term training courses is prepared for each academic year for circulation in advance. The roster shall indicate details regarding the dates, number and type of participants, broad programme of training, duration, etc. The proposals for organisation of short-term courses are to be submitted in the proforma at Annexure XXVII.

17.3 These courses are given in the basic agricultural sciences with a view to refresh and up-date knowledge of participants. Lectures are mainly confined to recent developments in the selected areas and their practical application to agriculture. The training includes library work so that the trainees become familiar with recent literature and know where to look for sources of information for future references.

For example, this Institute organises on a regular basis the following short-term training programmes :

(a) A three months' course on the use of radioactive isotopes in agriculture, organised once in a year.

(b) A six weeks' course on "Techniques for assessment of grain protein quality", organised once in two years.

(c) Four weeks' course on the use of X-ray techniques for assessment of grain protein quality", organised once in two years.

(d) A six weeks' course in seed testing and seed certification, organised once in a year.

(e) Four weeks' course in soil testing organised once in a year.

(f) A four weeks' course in colour photography for ICAR in-service candidates, organised once in a year.

(g) A one weeks' course in mushroom cultivation, organised once in a year.

The Division of Agricultural Extension also arranges a number of specialised extension training programmes and refresher courses on production technology, agricultural communication, development of the administration etc. for development staff and subject matter specialists of the Delhi Administration and other state departments of Agriculture. Young farmers training programme are also conducted periodically. Similarly the Water Technology Centre conducts a series of training programmes for irrigation scientists and engineers from various states on water management and efficient use of water in agriculture.

17.4 The detailed terms and conditions regarding eligibility requirements for participants, fees to be charged, duration, etc. shall be specified in the circular inviting nominations for participation in the course. A deposit of Rs. 200 is payable as caution money on admission which shall be refunded at the end of the training programme after deducting dues, if any.

17.5 (1) In addition to the above, training of duly sponsored candidates from the State Governments, Agricultural Universities, Research Institutes, Union Territory Administration etc. is also arranged on ad-hoc basis to meet the special requirements of particular organisations. In such cases, a tuition fee of Rs. 25 for a training course for one month or a part thereof shall be charged, besides the caution money from the participants/their sponsors.

(2) Where any special training programmes are organised for the employees of any commercial institution including Public Sector Banks/Enterprises or for the employees of any Society like the Fertilizer Association of India or private organisation in any desired scientific/functional area, a tuition fee of Rs. 75 per participant, besides caution money, per month or a part thereof shall be payable by the participants/their sponsoring organisation.

(3) As the Institute has responsibility for extension work in the Union Territory of Delhi, no fees shall be charged in respect of the participants in the training programmes conducted for the benefit of farmers, extension and social workers conducted at the request of the Union Territory Administration of Delhi or of the ICAR or the Govt. of India.

17.6 No tuition fee/accommodation charges will be leviable in respect of the participants in the Summer Institutes organised whether at the instance of the ICAR or the U.G.C.

17.7 At the end of each course, a manual shall be prepared by the course-in-charge which shall include details regarding names of trainees, period of training, curriculum and the papers connected with the training course. A copy of the manual shall be sent to the Dean and another copy kept in the library for record and reference

18 Registration of institute employees for higher degree of other universities

18.1 Eligibility

18.1.1 The scientists, upto and including Senior Scientist, of the Institute can be permitted to register themselves with outside universities for obtaining a higher degree, but they shall be required to complete the course of study and research work requirements for such degree by remaining on study leave and other leave of the kind due and admissible to them. However they will neither be given any facilities for research in IARI nor can any staff member act as guide to them.

18.1.2 The applicant should have completed a minimum of 3 years service in the Institute on the date of submission of application.

18.1.3 The application will be considered provided the authority competent to grant study leave certifies that the applicant would be granted study leave for two years and other leave for such period as may be required for completing the contemplated higher studies.

18.2 Procedure and time schedule for submission of application

18.2.1 The Board of Studies of the respective discipline shall, after taking into account the various factors like the number of staff members already registered with outside universities, review the position at the beginning of each academic year and decide as to the number of staff members who can be permitted to register themselves for higher degrees with outside universities in the year. In respect of Inter-disciplinary Units and non-teaching disciplines, such review shall be made by a Special Committee of that Unit/Establishment and the recommendations shall be forwarded to the Dean under intimation to the concerned discipline.

18.2.2 All applications for registration with outside universities shall be submitted to the P.G.School in duplicate in the prescribed proforma (Annexure XXVIII) after completing the formalities as mentioned in sub-rule 18.2.3.

18.2.3 The application for registration for higher degrees with outside universities shall be submitted to the Head of the Division, who will forward the same to the Joint Director (Admn.) within a fortnight after getting recommendation of the Board of Studies/ Special Committee as mentioned in sub-rule 18.2.1 above and adding his own comments. The Joint Director (Admn.) shall forward the applications of all the candidates who can be granted study leave to the P.G.School latest within one month.

The Dean's Office shall forward the applications within a fortnight of their receipt by it, provided the applications conform to all the guidelines.

18.3 Rules for taking of courses and issue of transcripts

18.3.1 The staff members registered for higher degrees may on request be allowed to audit or undergo courses offered by the P.G.School, IARI in the respective fields in which they specialise, provided their requests are transmitted to the P.G.School through the University with which they are registered and the IARI has the necessary intake capacity. They will be required to pay the tuition fee as is recoverable from students of other universities when they come for taking/auditing courses at IARI.

18.3.2 A staff member allowed to take or audit courses at the P.G.School, IARI, shall, *mutatis mutandis*, be governed by the rules as are applicable to regular students, regarding auditing of courses, credit-load and earning of grades, including attendance requirements.

18.3.3 Staff member registered with an outside university desirous of having a transcript for the courses he/she has taken at the IARI will make a formal application and a fee of Rs. 10/- will be charged for each such request.

18.4 Thesis submission

18.4.1 The topic of the thesis should be communicated to the Dean.

18.4.2 A copy of the finally approved thesis shall be deposited with the IARI Library.

18.4.3 On acceptance of the thesis and award of degree, intimation shall be sent to the P.G.School by the staff member concerned through the Head of the Division/Unit, for completion of the record.

18.5 Faculty membership during registration

If any faculty member is registered with another university for a higher degree, the faculty membership shall be discontinued and he/she shall not be eligible to act as a major adviser or member of the Advisory Committee of students.

19 Honorary Research Workers

19.1 The Institute provides research facilities* on a selective basis to *bona fide* research workers subject to certain terms and conditions.

19.2 Grand of facilities to such honorary research workers shall be considered only if the request received through the concerned institution; requests received directly from individuals shall not be entertained.

19.3 All requests for assistance in this category shall be addressed to the Dean of the Post Graduate School who shall be the competent authority to permit and the requests shall be processed in Post Graduate School Office. In all cases permission for carrying out research shall only be accorded by the Dean after satisfying that facilities for such work can be given, consistent with the activities of the Institute and subject to a maximum number in each Division to be decided by the Director.

19.4 Normally such workers shall be admitted for doing only post-doctoral work at the Institute subject to necessary facilities being available in the respective Divisions. However, special request for work at the post-graduate or other levels may be permitted by the Director on merit in consultation with the Head of the Division concerned and on such terms and conditions as may be specified.

19.5 At the end of every quarter, a statement of all honorary research workers admitted to various Divisions will be submitted by each Division to the Director.

19.6 A fee of Rs. 25 per month or part thereof together with admission fee, contribution to Students' Welfare Fund for admission in the capacity of a casual student and a caution money of Rs. 200 shall be paid either by the honorary research worker or the sponsoring institution.

19.7 The honorary research worker shall obtain the prior permission of the head of the Division for publishing the results of the research done.

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*Due to shortage of laboratory facilities it has been decided to keep extension of this facility in abeyance for the time being.

19.8 At the conclusion of the research work, the honorary research worker shall submit a report on the work done.

19.9 Honorary research workers shall not be entitled to hostel accommodation automatically. In the event of accommodation becoming available, they may be provided hostel accommodation on admission as casual students at the following rates :

(a) For less than 10 days : As per guest charges levied for guests of IARI students.

(b) More than 10 days : @ Rs. 20 per month.

(c) Employee-trainee : @ Rs. 2.25 per diem.

20 Courses and their Contents

20.1 Explanatory

All courses offered at the Post Graduate School of the Indian Agricultural Research Institute are listed by disciplines in alphabetical order. The courses listed represent the total syllabus in respect of each discipline and the actual list of courses to be offered in a particular academic year shall be decided by the Board of Studies of each discipline after taking into account available facilities and faculty strength; The Post Graduate School, therefore, reserves the right to cancel without notice any course listed for any trimester or to withdraw any course which does not have adequate enrolment at the close of the registration period or for any other reason.

20.2 Course numbers

Each course bears a distinguishing number which identifies it within the discipline and indicates, broadly, its level. The numbering system is as follows :

Elementary courses	:	100-198
Pro-Seminars	:	199
Advanced courses	:	200 and above
Seminars	:	299

20.3 Credits

20.3.1 The unit of credit at the Post Graduate School is the trimester hour, which represents approximately twelve hours of lectures (one hour per week for twelve week), and the necessary reading and preparation outside the class required for mastery of the subject matter fields covered in such a course of lectures or approximately twelve practicals of normally three hours duration each.

20.3.2 The number of hours of credit is given in parenthesis following the title of the course, the letter "L" and "P" standing for "Lectures" and "Practicals" respectively. If the credit is variable, to be fixed in consultation with the teacher and approval of the Dean, Post Graduate School, the fact is shown as 'credits to be arranged'.

20.4 Trimester designation

The Roman numerals, I, II or III, following the title of the course and the credit it carries, indicates the trimester in which the course is expected to be offered. Thus, 'I' indicates the course is to be offered in the first trimester; When the courses are offered irregularly and/or on demand, no Roman numeral follows the number showing course credit hours.

20.5 Periodicity of courses

The courses listed are generally offered once a year unless otherwise specified. In case a course is offered once in two years, the word "biennial" or "odd years" or "even years" is mentioned against the concerned courses.

20.6 Registration for courses in each trimester

Each student on rolls, whether taking course work or not shall submit on registration day of each trimester a roster in the prescribed form to the Professor of the discipline indicating the courses for which he/she would be registering in that particular trimester. No course not included in the PPW should be included in the roster.

20.7 Course contents

The details of the courses and their contents in respect of the 20 disciplines and the details of other courses viz., 'Introductory Agriculture', 'Agricultural Information System' and 'English Language Course' are given in the subsequent pages.

I Agricultural Chemicals

Major field : Agricultural Chemicals.

Minor field : Every Ph.D. student shall take not less than two minors (9 credits of course work in each) and every M.Sc. student not less than one minor (9 credits) in disciplines such as :

Entomology
Nematology
Mycology and Plant Pathology
Agronomy
Microbiology
Soil Science & Agricultural Chemistry
Agricultural Statistics/Computer Applications
Biochemistry
Plant Physiology
Mol. Biol & Biotechnology
Environmental Guins

AC.100 Fundamentals of Chemistry (3L + 1P)I

Chemical bonding, reaction kinetics, surface chemistry, solutions, acids and bases isomerism, stereochemistry, inductive effect, resonance and aromaticity; addition, elimination, substituttion, odixation and reduction reactions; reactive intermediates, carbanions, carbonium ions and free radicals; basic photochemistry and spectroscopy; survey of classes of organic compounds.

AC.101 Introductory Pesticide Chemistry (3L + 1P)I

Introduction, classification, historical development, nomenclature and chemistry of important pesticides viz., DDT, Parathion etc.; studies on organic functional group found in pesticidal molecules; chemistry of natural products such as carbohydrates, terpenoids, steroids, alkaloids and their importance in agriculture; formulation of pesticides, safe handling and applications;

studies on safety evaluation, regulatory measures as per insecticides act; Bureau of Indian Standards specifications on important pesticides.

AC.102 Basic Laboratory Techniques in Pesticide Chemistry (3L + 1P)I

Theory and practice of simple and fractional distillation of liquid pesticides; use of water and oil pumps, vacuum assembly, heating and cooling baths, mechanical stirrers for the preparation of pesticides; purification of common organic solvents used for the preparation of pesticides; semi-micro and micro techniques in preparation of pesticides, recrystallisation, sublimation, extraction using Soxhelt, liquid-liquid extraction methods; simple glass blowing techniques and general precautions in the field of pesticides.

AC.103 Formulation Chemistry-I (2L + 1P)II

Application of basic concepts such as viscosity, surface tension surface energy and interphasial tension etc., contact angle, role of surfactants, theory of emulsification, micelle formation and theory of micellisation, pH and its effect, adsorption and absorption phenomena, flowability, colloid and surface chemistry in pesticide formulation; types of formulation, their preparations and uses.

AC.200 Advanced Organic Chemistry (3L + 2P)I

Reaction mechanisms and important reactions like substitution, molecular rearrangement, stereo-chemistry with special reference to agro chemicals; synthetic reagents and their uses; modern methods of spectroscopy and chromatography; appraisal of general methods of isolation and characterisation of biologically active plant products viz. pyrethroids, rotenoids, nicotinoids etc.; chemistry of semio chemicals, antifeedants, pheromones hormones etc.

(Pre-requisite : AC.100)

AC.201 Chemistry of Insecticides (3L + 1P)II

Preparation, properties, uses, structure-activity relationships and mode of action of majorgroups of insecticides viz., organochlorine, organophosphorus, carbamates and pyrethroids.

(Pre-requisite : AC.100)

AC.202 Chemistry of Fungicides (2L + 1P)III

Preparation, properties, uses, structure-activity relationships and mode of action of major groups of fungicides viz., inorganic, dithiocarbamates, phenols, antibiotics, organo phosphorus, quinones, benzimidazoles oxathiins, pyrimidines, morpholines etc.

AC.203 Chemistry of Nematicides, Rodenticides and Molluscides (2L + 1P)III

Preparation, properties, uses, structure activity relationships and mode of action of major groups of nematicides viz., aliphatic halogen, organophosphorus, carbamates, inorganic and organic rodenticides, metaldehyde, carmates.

(Pre-requisite : AC.100)

AC.204 Chemistry of Acaricides and Insecticide Synergists (2L + 1P)III

Preparation, properties, uses, structure activity relationships and mode of action of organochlorine, organophosphorus, carbamate groups of acaricides; chemistry of synergists of natural and synthetic origin.

(Pre-requisite : AC.100)

AC.205 Chemistry of Herbicides and Plant Growth Regulators (3L + 1P)II

Preparation, properties, uses, structure-activity relationships and mode of action of herbicides viz., phenoxyalkanoic acids, carbamates, substituted phenyl ureas anilides, triazines, bypyridyl compounds, dinitroaniline, organophosphorus, arsenicals; plant growth regulators of natural and synthetic origin e.g., auxin gibberelins, cytokinins, MH.

(Pre-requisite : AC.100)

AC.206 Recent Advances in Agrochemicals (2L)II

Recent developments in the field of agrochemicals (insecticides, fungicides, herbicides etc.); advances in formulation and residue analysis; use of computer and mathematical models in designing pesticides; biotechnology in plant protection.

(Pre-requisite any three courses from AC.201-205)

AC.207 Formulation Chemistry-II (2L + 1P)III

Improved formulation of pesticides with adjuvants such as synergists, attractants, repellents and antifeedants etc., technological advances in pesticide formulations, formulation machinery and equipment and application aspects; quality control and adulteration in pesticide formulation.

(Pre-requisite : AC.103)

AC.208 Analytical Chemistry of Pesticides (3L + 2P)II

Principles of sampling, extraction, clean up of pesticides in different substrates; analysis of pesticides and their residues, the modern analytical techniques; persistence of pesticides in soil and plant systems.

AC.209 Metabolism of Pesticides (3L + 2P)I

Abiotic and biotic metabolism and chemodynamics of pesticides in soil, plant, water and animal system; photometabolism and microbial metabolism of pesticides.

(Pre-requisite any three courses from AC.201-205)

AC.299 Seminar (1) I/II/III

Core Courses :

A. For M.S.c

Within the discipline : AC.100, AC.101, AC.102, AC.103

B. For Ph.D.

Within the discipline : AC.200, AC.206, AC.209.

II Agricultural Economics

Major field : Farm Management and Production Economics
Agricultural Marketing and Prices
Agricultural Finance and Cooperation
Agricultural Econometrics
Agricultural Development and Policy

Minor fields : A student majoring in one of the above fields may elect to take a minor in any of the other recognised major fields of the discipline. But every student shall take not less than one minor (9 credits of course work) in another supporting major field from disciplines such as :

Agricultural Extension
Agricultural Statistics/Computer Application
Agronomy
Environmental Science

DESCRIPTION OF COURSES

Ag.Econ.100 Economic Theory (4L)1

Brief history of economics Definitions, Macro and Micro-economics. Economic methodology and analysis, Central problems of economic society, Economic Systems, Mixed economic system. Supply and demand, the market mechanism, the demand schedule, the demand curve, the supply schedule, equilibrium of demand and supply,shift in supply and demand, elasticity of supply and demand, elasticity measurement, different kinds of elasticities and their economic significance. Supply and demand as applied to agriculture. The theory of demnd and utility : Different approaches to the sudy of consumer behaviour. Geometrical analysis of consumer equilibrium in different approaches. Marginal utility, law of diminishing marginal utility, Indifference curves, marginal rate of commodity substitution, price line. Demand shifts from income and other charges, cross relations of demand, substitution and income effects. Price consumption and income consumption curves, consumers surplus. The theory of competitive supply. Firm supply and market supply curve, marginal cost and short run supply of the firm, market synthesis in the competitive system. Analysis of costs and long run supply, long run indsutry supply and firm's break-even points, External economies and diseconomies. The theory of production and the theory of distribution : Demand for factors of production, production function marginal product and the law of diminishing returns, Graphical analysis of theory of production, Factor pricing. Marketing structure : Perfect and imperfect competition, forms of imperfect competition, price and output determination under different market structures. Market imperfection and resource allocation. National Income and Product : The Yardstick of an economy's performance, Measures of national product, net investment and capital formation. GNP and NNP, Disposable personal and national income. Determination of National Income : Saving, consumption and investment, saving and investment motivations. The propensity to consume and save. The simple multiplier theory, Intersection of saving and investment schedules, The multiplier, Graphical analysis of the multiplier.

Ag.Econ.101 Micro-economics-I (3L)II

1. Theory of consumer behaviour : Introduction to the theory of consumer behaviour, utility function, The cardinal utility theory, Equilibrium of consumer, Derivation of demand for goods, Critique of the Cardinal approach.

The indifference curve theory, Equilibrium of Consumer, Derivation of demand of commodities, Critique of the Indifference Curve Approach, Income & Substitution Effects, The Slutsky Theorem, The Hicks Theorem, Compensated demand functions.

The Revealed Preference Hypothesis, Axioms of Revealed Preference, Derivation of demand, critique of the revealed preference hypothesis.

Recent developments in the theory of demand, Dynamic versions of demand functions, Constant Elasticity demand function, Linear expenditure system, Empirical determination of demand relationships.

2. The Theory of Firm : The production fucntion, concepts of productivity curves. Elasticity of production, Isoquants-Properties of Isoquants, Marginal rate of substitution, Elasticity of substitution, Optimising behaviour, constrained output maximization, Cost minimisation, Profit maximisation, Derivation of input demand function from production functions, Homogenous production functions, Euler's Theorem, Return to scale, Theory of costs, Average cost, Marginal cost, Profit maximization using cost approach, Optimum level of output, Technological progress and production functions.

Joint products, Concept of production possibility curve-Isorevenue curve constrained, revenue and profit maximization.

3. Perfect Competition & Market Equilibrium : Classification of Markets, Market demand & Producers demand, commodity market equilibrium in short run and long run, Supply curve of the firm and industry, External Economies and diseconomies. Factor market equilibrium. Effect of tax and effect of change in the cost on the equilibrium under perfect competition.

Ag.Econ.102 Macro-Economics-I (3L)II

Concept & Measurement—Basic concepts, National Income, Product, Wealth, Money, Price Level, Employment, Unemployment & Output in the economy.

Employment Theory—Say's Law, Quantity theory of money, Wages, Prices, Employment & Production, Classical theory of saving, Investment & Interest Rate.

The simple Keynesian model—Consumption function, Fiscal Policy & Keynesian Dynamics.

Keynesian and Classical synthesis—Keynesian theory of interest, IS-LM form of the model, classical version of the synthesis.

Input-output model, the concept of full employment, Inflationary gap.

The theory of Income determination and multiple market economic systems, Multiplier and accelerator analysis, The Walrasion, Keynesian, Fisherian & Samuelsonion systems.

The integration of macro-economics with monetary analysis in the context of both open and closed economies.

Ag.Econ.103 Welfare Economics (3L)III

Nature and scope of Welfare economics : basic concepts, problems, approaches and limitations of welfare economics value judgements and welfare economics. Pareto conditions of maximum welfare. Perfect Competition and attainment of maximum welfare.

Limitations and failures of the market economy in attaining the maximum welfare : Monopoly externalities in production and consumption, ignorance, risk and uncertainity etc. Theory of welfare in a dynamic setting. Recent developments in the measurement of welfare.

Criteria of social welfare (Bentham, Pareto, Kaldor-Hicks, Bergsen-Samuelson etc.) social welfare functions, social versus private costs and benefits. Political aspects of welfare economics : importance of the public sector, the critical explorations of its problems, decision making in the public sector, the aggregation of individual preferences relating to collective or individual goods and services and problems of collective choice.

Some applications of the theory of welfare economics in policy analysis : Taxes, prices and welfare, investment, growth and welfare, employment and welfare, international trade and welfare.

Ag.Econ.110/AS-260 Agricultural Econometrics-I (3L + 1P)II

Representation of economic phenomenon, relationship among economic variables linear and non-linear economic models.

Ordinary least squares methods of estimation of simple and multiple regression models. The BLUE Properties of least squares estimate Tests of significance and confidence intervals. Summary statistics—Correlation matrix, residual variance, Co-efficient of multiple correlation, standard errors of estimated coefficients and their uses, Partial correlation and its uses. Maximum likelihood estimation.

Multicollinearity, principal component analysis, use of dummy variables, Generalized Aitken's least-squares methods of estimation, Random coefficients models, stochastic regressors, Heteroscedasticity, Auto-correlation, Durbin-Watson test, Estimation from grouped data, specification errors.

(Pre-requisite : Ag.Econ.101)

Ag.Econ.111/AS-263 Agricultural Econometrics-II (3L)I

Mixed estimation, Use of instrumental variables in regression analysis, Errors in variables models. Distributed lag models—alternative specifications—partial adjustment and adaptive expectations models, partial adjustment-cum-adaptive expectations models, Grouping of observations, Grouping of equations.

Simultaneous equation systems : Basic rationale, identification problems, Single equation methods of estimation-indirect least squares, two stage least squares, and K-class estimators, and limited information maximum likelihood, system methods of estimation (three-stage least squares, and full information maximum likelihood), Relative merits of these methods and their small and large sample properties, Recursive models.

(Pre-requisite : Ag.Econ.110)

Ag.Econ.120 Agricultural Production and Resource Economics-I (2L + 1P)I

Farm management-nature, scope and objectives. Characteristics of farming and requirements of success in farming. Task of management, classification of decisions and the process of decision making in farming. Measurement of management input in farming. Types and systems of farming and factors affecting types of farming.

Basic principles of farm management—principles of marginal returns, costs substitution in choice of practices, equimarginal returns, combining enterprises and time comparison. Law of comparative advantage.

Farm records and farm accounting. Concept of size of farm and farm business, Measures of farm efficiency, Methods of evaluating farm assets, outputs and inputs, Methods of working depreciation, Cost concepts.

Essentials of farm planning and budgeting—farm surveys, questionnaire, preparation and pretesting, data collection and analysis, enterprise budgets, partial budgets and whole farm planning.

Elements of risk and uncertainity in agriculture, measurement of risk and adjustments to risk, Review of farm management research, education and extension in relation to changing needs in India.

Ag.Econ.125 Water Resource Economics (3L)III

Objectives of watershed policy; economic criteria for watershed policy, relevance to price system; water resources developement in relation to total resource development; regional distribution of benefits.

Watershed problems; inter-disciplinary framework in planning, and project formulation; the state of economic data; criteria for investment in water resource devevelopment; water project evaluation—cost benefit analysis; in-depth studies of the influence of time; interest rates; externalities, non-market benefits; pricing and investment criteria on water project evaluation; case studies.

Ag.Econ.126 Water Institutions and Water Laws (3L)I

Various uses of water; water in agricultural production; development of water users insitutions for India; reviews of legislation by State and Central Government; public regulation and legal problems, water organisations and enterprises; kind of oranisation in various countries of the world for management of water resources such as cooperatives, associations, districts, mutual-commerical etc.; pricing of water by volume or flat rate by local, state or Central Government—water rights, kind, acquisition and administration; allocation of irrigation water; legal aspects of water quality control, policies of inter basin transfer and transfer between basins and States; adjudication of ground water basins; percolation and recharge water and conjunctive use of surface and ground water, review of water codes; tenure; property rights, land fragmentation and land consolidation problems.

(Pre-requisite : Ag.Econ.100)

Ag.Econ.127 Land Economics (3L)II

Distinction between land tenure and land reforms; land tenure—analytical concept, land reforms analysis within a specific situation.

Various causes of land reforms and illustrations. History and development of land tenure in different regions of the world such as the United States, United Kingdom, France, Soviet Union, Japan, Taiwan, Mexico, Philippines, India.

Student reports on land tenure—land tenure and agricultural development.

(Pre-requisite : Ag.Econ.100)

Ag.Econ.130 Marketing-I (Economics of Marketing) (4L)III

Marketing and Price in an Exchange Economy—Concept of the Market, Individual and aggregate Demand, Individual and aggregate Supply, Price Equilibrium, Joint Demand for Goods & Services, Multiple Price Markets, The Perfect Market Concept.

Price Equilibrium in spatially separated markets—The two region case, Introduction of transfer costs, Multi-region models, production and consumption fixed, production and consumption variable, Limitation of single product analysis.

Space and Transfer Cost—Component of transfer cost, Distance cost relationships, Transfer cost surface, Effect of transport net work on costs, Alternative modes of transportation, Combined modes of transportation, Collection & Delivery routes.

Markets with spatially Dispersed Production—Spatial dispersion, Site—Price surface, The law of market areas, Boundries between competing markets, Inter-related markets, Minimising transfer cost, Production costs and irregular transfer costs, Applicability to real markets.

Efficient organisation within Market, Areas— Product assembly, Isolated Plant sites, Competing Plants, Processing Plant numbers and costs, Efficient distribution system, Spatial monopoly, Efficient spatial allocation.

Price Equilibrium with Alternative Product Forms—Product form choices, Product Price boundries, Role of processing costs, Short run plant costs, Multiple service plants. Multiple Product Forms and Spatially separated Markets—Net values of raw product, Identification of product boundries, Role of market demand and supplies, Point trading, space-form models, Competing markets with production dispersed, Seasonal variation in product boundries, Selection of product form, Long run adjustment to seasonal variations.

Temporal Market Price Relationships—Time dimension and storage costs, Two Period demand case, Multiperiod demand case, Carryover between production periods, Spatial and seasonal price model.

Price discrimination Among Markets—Types of price discriminations, Modes of behaviours of the firm, Price differentiation among markets, Form, Time and Space.

(Pre-requisite : Ag.Econ.101)

Ag.Econ.131 Agricultural Markets in India (3L + 1P)II

The Marketing Environment—The interlinking of rural markets for money, land, labour and agril. commodities, The size and distribution of marketed surplus; The orgnisation and working of agril. markets; Marketing reforms Market regulations—Grading—Marketing Boards; Agril. Marketing Policies—State intervention—Procurement and Distribution—Buffer Stocks.

Structure of Foodgrains Markets—Market Functionaries—Practices—Functions—Cost margin—Horizontal and vertical integration—Pricing Efficiency—Barriers to Entry—Number and size Distribution of Buyers and sellers.

Structure of commercial crops markets. Structure of live stock and livestock products markets. Structure of Inputs Markets. Development of processing industries. Development of storage & warehousing. Financing of agricultural marketing. Government & Agril. marketing. Cooperatives in Agril. Marketing. Efficiency and equity in agril. markets. Future trading speculation, Profitability and Price stability in Commodity Markets.

(Pre-requisite : Ag.Econ.101)

Ag.Econ.132 Seed Marketing (2L + 1P)II

Concept of Seed Marketing and Marketing Management; Economics of Seed Production : Analysis of Marketing, Prices; Organization : Distribution Channels; Pricing Policies; Regularisation under Seed Act; Sales Promotion; Market Research.

(Pre-requisite : Ag.Econ.101)

Ag.Econ.140 Agricultural Co-operation (3L)II

Agricultural Cooperation in India and Abroad—Cooperative Legislation—Cooperative accounts.

Forms of Business Organisation—Definition of Cooperation—Objectives of Cooperative institutions and Rochdale Principles. Primary and Secondary Principles of Cooperation—Determining the need for cooperation—Steps in organising a cooperative society.

Progress of the cooperative movement in India—Trends of Policy and progress from1919 till 5th five year plan—Multi agency approach. Role of Coops in Financing Agriculture. Rural cooperative credit societies—State participation in share capital—Central Cooperative Banks—State Cooperative Banks—Land Mortgage Banks—Regional Rural Banks—Cooperative Farming—Cooperative Marketing—Cooperative processing.

Cooperatives and the State—Cooperatives and community Development—Role of R.B.I. and State Bank of India in the scheme of cooperative finance—Cooperatives as a tool for transfer of technology—Cooperatives as a link between agriculture, industry and consumer services—Cooperatives as a link between agriculture, indsutry and consumer services—Cooperatives as a coordinating factor for national planning and local initiative activity and work incentives in cooperative societies—Cooperatives as a tool for development in the context of traditional background of developing countries.

Visit to relevant institutions and agencies would form an integral part of this course.

In addition, the student will be obliged to prepare a research paper related to the course outline.

Ag.Econ.201 Micro Economics-II (3L)III

Market Equilibrium; Existence, uniqueness and stability, Dynamic equilibrium with lagged adjustment. General competitive equilibrium; Definitions of competitive equilibrium, fixed point theorem, Existence, Uniqueness and stability of general competitive equilibrium.

Theory of Monopoly : Relation between marginal and average revenue, Equilibrium of the monopolist, profit maximisation using production function approach, The price Discriminating monopolist, Multiplant monopolist, effect of taxation on equilibrium, Long Run Equilibrium, The Revenue maximizing monopolist. Monopolistic Competition : Equilibrium of firm product differentiation oligopoly and Duopoly : The Cournot solution, Collusion solution Chamberlin Model, The Kinked Demand Model. The stackelberg solution, Theory of bilateral monopoly, Theory of monopsony, duopsony and oligopsony.

Theory of Distribution : Factor pricing in prefectly competitive and imperfectly competitive markets, Rent wages, Interest and prices, Elasticity of factor substitution, Technological progress and income distribution. The price of fixed factors. Rents and quasirents, Non-homogeneous factors and wage differentiation, The 'Adding Up' and Product Exhaustion theorems.

(Pre-requisite : Ag.Econ.100)

AG.Econ.202 Macro Economics-II (3L)III

Introduction to Dynamic Macro—Economic Models, Inflation and unemployment, The supply side tax effects, The use of rational expectations, Business cycle and its alternative equilibrium models, Stability analysis.

Monetary and fiscal policies, Fiscal Policy as an instrument of development, incidence of tax and fiscal policies.

Public Borrowing—Internal and external aid, Deficit financing, Development Financing, The international general equilibrium system, Impediments to global efficiency, International macro economic policies, IMF, IBRD, UNCTAD, NIEO. Students desiring to undertake in depth study may be encouraged for any group wise visits to international economic institutions.

(Pre-requisite : Ag.Econ.101)

Ag.Econ.210 Agricultural Econometrics-III (2L + 1P)II

Analysis of family budgets, Engel curves, Estimation of consumer demand models—Linear expenditure model, Indirect addilog demand model, Rotterdam differential demand model, Normalized quadratic demand model, Generalized quadratic demand model, Generalized Leontief demand model, Transcendental lograthmic demand model (formulae for price and income elaticities of demand).

Estimation of consumption functions—Keynes consumption function, Friedmans consumption function. A lagged consumption model.

Estimation of Cobb-Douglas, CES and VES production function and the elasticity of factor substitution. Estimation of cost functions and normalized profit functions.

Pooling cross section and time series data. Monte Carlo Studies. Simulation in agricultural economic analysis. Spectral analysis.

(Pre-requisite : Ag.Econ.110,111)

Ag.Econ.211 Agricultural Econometrics-IV (2L)II

Bayesian Econometrics. Principles of Bayesian analysis including Bayes theorem, Priori probability, density functions, marginal and conditional posterior distributions for parameters, point estimates for parameters. Application of principles to analysis of the Pareto distribution, Binomial distribution. Analysis of univariate regression model, application to investment multiplier, consumption function estimation, Analysis of regression model with auto-correlated errors.

(Pre-requisite : Ag.Econ.110,111,210)

Ag.Econ.220 Agricultural Production and Resource Economics-II (2L + 1P)III

Production concepts. Resource product relationships in agriculture. Important historical background and characteristics of different forms of production functions—linear, quadratic square-root, Spillman cubic, semi-log, Cobb-Douglas, transcedental, CES, VES and Leontif, Production surfaces, isoquants and isoclines, economic application. Principles of choice and resource allocation. Price and production relationships. Resource combination and cost minimization.

Multiple product relationships. Production possibility curves. Choice between products and resource use. Spatial and temporal allocation of resources.

Returns of scale and farm size. Analysis of factor shares in agriculture and their implications on income distribution.

Dualities between production, cost and profit functions, Derivation of supply and factor demand functions from production and profit functions.

(Pre-requisite : Ag.Econ.101)

Ag.Econ.221 Agricultural Production and Resource Economics-III (Linear Programming) (2L + 1P)I

Problem formulation for programming, preparation of input-output matrix, objective functions and constraint equations.

Simplex method and its application for solving agricultural problems, use of artificial factors, Problems of degeneracy, inconsistency, infeasible and unbounded solutions. The generalised simplex method, The dual method, The dual simplex method.

Application of linear programming for solving practical problems in farming with the help of following : Variable resource programming, Variable price programming, Integer Programming Recrusive programming. Risk programming (MOTAD), Application of linear programming for solving game problems in farm decision making.

(Pre-requisite : Ag.Econ.220)

Ag.Econ.225 Economic Analysis of Water Use (2L)II

Application of production function; programming and mathematical models of Computer simulation/systems analysis to water allocation and management problems; types of basic data required; conventional allocation methods and their limitations; allocation of water amongst agriculture and other uses; farm level decisions.

(Pre-requisite : Ag.Econ.125)

Ag.Econ.230 International and Inter-Regional Trade in Agricultural Commodities (4L)II

The Pure Theory of International Trade—The theory of comparative advantage; International trade equilibrium, stability properties and some comparative static results; Neo Ricardian theory; Role of non-factor services; Uncertainty.

Trade and Welfare : Tariff and Nontariff Barriers.

Factor Mobility and its Implications for : The International location and specialisation of economic activity; Labour migration; International capital flows; Transfer of technology; Role of multinational corporations.

Trade Problems of DDC's with special reference to India : Export instability; Terms of trade; Role of UNCTAD & GATT.

Economic Interdependence and Inter-regional Trade—Interdependent economic activities; Interdependence within agricultural sector; Reasons for regional specilisation; Interregional trade flow; Mobility of production factors.

Short Run Trade Flows—Concept of utility; Consumer equilibrium; Barter between individuals; Individual : "offer" curves; Short run regional offer curves.

Regional Poduction Potentials. Alternative production opportunities; Opportunity cost curves—single homogeneous factor; Opportunity cost curves—Multiple Factors; Long run opportunity cost curves; Factors affecting opportunity cost curves.

Long Run Regional Specialisation : Production adjustment and individual offer curves; Regional production and trade; Product Prices and Factor Prices; Regional differences in production technology; The gains from trade.

Land use equilibrium Models—Land use equilibrium with multiple markets, Comparative advantage, specialisation and trade; opportunity cost curves and transfer costs.

Spatial Equilibrium with Mobile Resources—Production location with localised raw materials; Unequal non-proportional transfer costs; Optimum location with more than three points; Alternative raw material sources and non transfer costs; Labour as a mobile resource.

General Equilibrium in an isolated Region—A simple general equilibrium system; Modified general equilibrium system; L.P. formulation with alternative production processes; Introduction of intermediate commodities; Consideration of joint production.

Multiple Region Production & Trade Models—An output oriented formulation; A resource oriented formulation; Multiple resource restraints; Trade in intermediate commodities.

(Pre-requisite : Ag.Econ.130)

Ag.Econ.235 Agricultural Price Analysis (4L)II

Agricultural sector and price determination. The characteristics of the demand for and supply of farm products. Models under-lying the behaviour of agricultural product prices. The characteristics of the demand for and supply of factor inputs in agriculture.

Vertical integration and its effects of agricultural price formation. Storage and buffer stock; price stabilisation measures and policies. Price discrimination. Speculation, futures market and price stability.

(Pre-requisite : Ag.Econ.110)

Ag.Econ.240 Agricultural Finance (3L)III

Definition and Scope of Agricultural Finance. Its relationship with Farm Management, Land Economics, Principles of Economics, Psychology and Sociology. Growing Emphasis on Agricultural Finance in the Third World Countries. Changing concept of Agricultural Finance with special reference to India. Introduction to public Finance, Agricultural Finance as a part of Public Finance.

Capital in Agriculture—Classification of capital working capital and fixed capital—Divisible and Indivisible capital—Owned and Borrowed capital. Sources of Capital.

Meaning and concept of Agricultural Credit—Capital and credit—credit as a substitute for savings—Credit and saving—Classification of Farm Business Credit—Production versus consumption credit—Desirable characteristics of the loan, Credit as a tool for economic development. Different methods of charging interest—Cost of credit.

Financial Accounting System : Balance sheet analysis—its valuation difficulties—Income Statement Analysis—Inventory Adjustments—Percentages and Ratios.

3R's of Credit-3 C's of Credit and their relation to 3R's of credit. Return as a guide in use of credit-Marginal Analysis-Budgeting. Incorporating risk in budgeting. Repayment capacity—Self liquidating loan—Non-self liquidating loans—How to strengthen the repayment capacity, Terms of payment Different types of risks— Risk bearing ability—Increasing owner equity—Stabilising income—Diversification, insurance, flexibility and contracts. Internal cash/asset rationing—Internal credit rationing—external credit rationing.

Legal aspects of credit—Real estate mortgage—Title theory Chattel mortgages : Livestock, Crop, commodity, equipment, miscellaneous. Promisory note—sales contract—other credit instruments.

Concept of supervised credit—objectives of supervised credit—Procedures, costs and sources of funds for supervised credit Supervised credit and extension agencies.

Agricultural taxation—Investment criteria (portfolio analysis).

Brief review of institutional lending procedures in India.

(Pre-requisite : Ag.Econ.101,102,120)

Ag.Econ.241 Agricultural Finance-II (3L)I

Review of trends in agril. credit policy of India—Relative importance of various credit agencies. Reasons for the predominance of private credit agencies. Causes of the limited success of co-operative. Structure of credit cooperatives. Rural credit survey report. Various Rural Debt and Investment Surveys.

Cooperative Banking Institutions—Role of cooperatives in financing agril. Social control of credit : Bank Nationalisation, Lead Bank schemes, Group lending, Role of commercial banks in financing agriculture, Rural credit review panel report—Multi agency approach. Small farmers development agencies. Role of State Bank of India in financing agriculture. Role of Reserve Bank of India in financing agriculture. Agricultural financing and infrastructure Programmes for weaker sections. Credit guarantee scheme—Crop insurance. Agricultural Finance Corporation, Agricultural refinance corporation, NABARD—Agricultural Taxation, Agricultural subsidies and Indian Agriculture.

For this course the students will be obliged to select a topic related to the course outline and carry on independent study and investigation and accordingly submit a paper.

As and when possible, the students will undertake guided tour to relevant financial institutions.

(Pre-requisite : Ag.Econ.240)

Ag.Econ.250 Agricultural Development and Planning **(3L)I**

Role of Agriculture in economic development, Theories of Agricultural Development Conservation, Urban-Industrial Impact, diffusion, induced innovation; Economics of traditional agriculture, allocative efficiency, risk and uncertainty, Sociocultural and other institutional constraints, planning for utilization of surplus resources including manpower, choice of appropriate agricultural technology; choice of appropriate farm organisation; Review of agricultural development in U.S.A., Japan, China and India.

Ag.Econ.251 Economic Development **(3L)II**

Concepts of economic growth, economics of development and under development : Theories of economic growth-classical, Marxian, Keynesian and neoclassical growth theories; Theories of under development—Low level equilibrium trap, critical minimum effort, big push; take-off, Social and Technological dualisms. Models of economic growth—Harrod-Domar, Kaldor Mahalanobis, Lewis & Fei-Ranis. The roles of capital accumulation, Human capital and Technological change in economic development, Strategy of economic development—Balanced vs. Unbalanced growth, Choice of Technique, Investment criteria.

(Pre-requisite : Ag.Econ.101,102)

Ag.Econ.252 Agricultural Policy **(3L)II**

Meaning of agricultural policy, criteria for policy, means ends and conflicts of objectives, a simple model of welfare maximization, agricultural policy for interpersonal and inter-regional balances in growth, cost-benefit analysis of agricultural projects, Production policy—Food vs. non-food crops, crop productions vs live-stock and poultry, Food policy—production, marketing and distribution, evaluation of agricultural price policy in the short run and long run, Agricultural taxation and subsidy, Land policy including land uses and land reforms, credit policy, Allocation of public funds including research funds and institutional credit among regions and commodities, population—energy policy, The working of agricultural policy under different economic farming systems.

Ag.Econ.253 Environmental Economics **(3L)I**

Meaning, nature and scope of environmental economics; Need for study of environmental economics; Agricultural development and its effect on ecology and environment; Natural resource accounting, Inter-temporal use of natural resources, Sources of inefficiency in natural resource use—market behaviour, property rights and government policies; Loss of fertile soil, desertification, salinization of land, water-logging, rising water table; Elements of environmental degradation in agriculure—Sub-optimal land use practices like overgrazing, shifting cultivation, mine spoils, industrial effluents, kilns and borrow pits, use of fertilizers, insecticides/pesticides and their reach to people through food; Environmental costs of technological advances; Use of agricultural inputs and practices and its economics in relation to environment, equity and ecology; Environmental problems in developing and developed nations; Population and environmental sustainability; Concern for environment in Indian planning, peoples involvement and movement on environmental issues.

Need for environmental protection : An economic overview; Elements of environmental protection—sustainable agriculture and its dimensions—ecological, economic, technological, social and political; Preservation of biological diversity, prevention of desertification,deforestation, salinization of land; Integrated farming—crops—livestock—forestry and fisheries, organic farming; Institutional measures to protect watersheds and ground water; Regulatory tools that use market forces to protect the environment; Economic instruments for environmental protection; Food security and environmental protection; international trade and environmental protection; Common property resources and natural resource management; Forestry, trees and natural resource; Development conservation; Agricultural policy and legislation for sustainable agriculture.

Ag.Econ.261 Research Methods (3L)I

Selection and formulation of agricultural economic research projects. Preparation of scientific reports and thesis.

Sampling; Sampling methods—block, area, systematic, simple and stratified random sampling, non-sampling errors, non-response in surveys.

Methods of data collection—interview and non-interview survey, cost accounting method. Preparation of interview schedules. Mechanics of analysis—coding, tabulation testing, presentation and intepretation for audience or publication.

Analysis of economic time series components and their interpretation. Growth curves and their estimation. Index numbers, their characteristics and construction of price and quantity index numbers.

Linear programming : Classical optimization method, linear programming as a special case general mathematical programmaing. Simplex method revised simplex method, Artificial vectors—Problems of degenracy, Parametric programming. Duality theorem. Post optimality analysis and parametric linear programming. Risk programming (MOTAD) Programming. All integer and mixed integer linear programming.

Ag.Econ.320 Agricultural Production, Resource Economics-V (Agricultural Production Under Risk) (2L)II

Various types of risk in Agriculture and their measurement : Decision Theory : Introduction to decision analysis, Concept of probability, subjective probability and its illustration, estimation of posterior probability in the application of Bay's Theorem. Selection of optimal action under risk with and without forecast device. Minimax and Maximin Criterion General Model of Discrete Decision Analysis.

Risk response analysis—Supply response risk, Formulation of production function under risk, Optimum input decision under risk.

Risk Programme Model—Linear risk programming model, Portfolio selection or E-V model, Markowitzs model, McInnerrey's model, Hazell model, Kataoka model.

Ag.Econ.321 Agricultural Production and Resource Economics-V (System Approach and Simulation in Agriculture) (2L)I

The system approach systems terminology, general system theory, categories of models static deterministic models, dynamic deterministic models, static stochastic models, dynamic stochastic models, some imperfections of the classifications, Applicability of the classified models, The uncertainty principles of modelling.

Simulation methodology, perspective on application. Application in agricultural economics, systems analysis. Similar components, methods, related steps. Alternate categories of models, system analysis relationship from empirical data, System synthesis, model sensitivity, Conditional sensitivity under restricted seeding, statistical assessment. Attending the sensitivity model.

Ag.Econ.322 Agricultural Production and Resource Economics-VI (Water Resource Economics) (3L)II

Objectives of watershed policy-economic criteria for watershed policy, relevance to price system, water resource developent in relation to total resource development, regional distribution of benefits, watershed problems, interdisciplinary framework in planning and project formulation. Water project evaluation, benefits costs measurements, and benefit cost analysis.

Water user institutions in India, reviews of legislation by states and central government, public regulation and legal problems. Water rights and administration, legal aspects of water quality control policies of inter basin transfer and transfer between basins and states, adjudication of groundwater basins. Review of water codes, tenure, property rights, land fragmentation and land consolidation problems.

Ag.Econ.331 Marketing Management (4L)III

The scope and concept of marketing and marketing management. Company orientation towards marketing—Production, marketing concept and societal marketing concept, product concept, selling concept. The broad concept of marketing. Macro & Micro marketing.

Marketing role within the firm.

Marketing role in society.

The marketing management process-analysing marketing, opportunities researching selecting target markets, and developing strategies, planning marketing tactics, implementing and controlling the marketing strategy.

Analysing market structure and behaviour :

Elements of the company microenvironment—Company, Suppliers, intermediaries, customers, competitors, public—Elements of company's macroenvironment—demographic, economic, physical, technological, political/legal and socio/cultural.

Consumer markets and behavioural dimensions of consumer markets. Major factors influencing consumer behaviour, consumer's problem solving process (buying decision process), Models of consumer behaviour.

Organizational markets and buying behaviour—Industrial resell and government markets and factors influencing purchase decision in these markets.

Researching, Selecting Marketing Opportunities and Developing Marketing Strategies :

Marketing information system and marketing research concepts and components of marketing information service.

Demand measurement and forecasting—Concepts of demand measurement and forecasting, estimating current demand and future demand.

Market segmentation, targeting and positioning—Market segmentation procedures, bases and requirements for effective segmentation, Market targeting, Product positioning.

Market strategy planning, market strategies in different stages of product life cycle.

Planning marketing tactics :

Capital Product decisions, Pricing decisions, Marketing channel decisions, Physical distributions, Promotion decision-advertising, sales promotion, publicity and personal selling.

Implementing and Controlling Marketing effect :

Marketing organization—evaluation of marketing department in the corporation, relationships of marketing department with other departments.

Marketing strategy implementation—requirements for effective implementation;

Marketing Control—annual plan control, profitability control, efficiency control, strategic control.

(Pre-requisite : Ag.Econ.230)

Ag.Econ.332 Quantitative Analysis of Marketing Problems—Application Studies (3L)III

The role of models in marketing; Use of mathematical models; Allocation models—The assignment problem, the transportation problem, Media selection problem, Channel selection problem, product line selection problem, Blending problem.

Competitive Strategy; Models—Blending problems, Equipment purchase problems Pricing problems, Sequencing problems.

Brand-Switching Models—Market share problems, Personnel management problems;

Waiting line models—Facility planning problems at market yards, Service facility problems;

Network Models—Problems of new product introduction, Problems of moving markets to new locations, Planning problems of marketing projects like processing development, etc.;

Inventory Models—Multistage perishable fruit inventory problems, Manpower planning problems, Pipeline storage inventory problems, Buffer stock problems.

(Pre-requisite : Ag.Econ.131,331)

Ag.Econ.360 Agricultural Project Analysis (3L + 1P)II

Definition of a project, identification and formulation of project, need for project, ex-post and ex-ante, appraisal, basic data requirement, discounted cash flow analysis and measure of probability, choice of discount rate, consideration of alternatives, divergence of private and social profits, government actions to bring about equality of social and private profits, social objectives and accounting price.

Allocation of scarce resources; land, labour, capital foreign exchange; present and future consumption, optimum use of taxes and subsidy.

Public ownership and planning, relationship between plans and projects selection and investment programme; private sector projects, method of evaluation of private projects, social cost-benefit and switching values, uses and abuses of sensitivity analysis.

Accounting prices for traded and non-traded goods, marginal social costs and marginal social benefits, financing of projects scale and fixing of projects impact of project outputs on production and consumption elsewhere. Shadow wage rates and accounting rate of interest, uncertainty and investment criteria, external effects related to inputs and outputs of the projects, indicators of economic worthiness in project appraisal; period of recovery capital output ratio, accounting rate of return, benefit cost ratio, internal rate of return, net present value, comparison of indicators.

Ag.Econ.361 Operation Research (3L)III

Necessary and sufficient conditions for constrained maximum and minimum, local and global maximum convex sets and functions Weirstrauss theorem, general mathematical programming problem, non-linear programming and its relationship with classical and linear programming, Kuhn-Tucker sufficient conditions, Slaster's conditions, quadratic programming, stochastic and chance-constrained programming, separable convex-programming, dynamic programming.

Ag.Econ.299 Seminar I, II, III

Core Courses

For M.Sc.

(i) Within the discipline 'Agricultural Economics' Ag.Econ. 101, 102, 110, 120, 130, 201, 202, 240, 250, 261

(ii) Outside the discipline

  a) AS-108, AS-109, AS-121 (Agricultural Statistics)

  b) AIS (Library Sciences)

For Ph.D.

(i) Within the discipline; Agricultural Economics :

  a) Ag.Econ.111

  b) All the core courses listed for M.Sc. students in case the Ph.D. students have not taken the corresponding courses in their Master's degree programme at IARI.

(ii) Outside the discipline

  a) Agri.Stat. : AS-129/CS 112, All the core courses listed for M.Sc. Students in case the Ph.D. student has not taken the corresponding courses in his/her Master's degree programme at IARI,

  b) 'Library Science : AIS, in case the Ph.D. student has not taken this course in his/her Master's degree programme at IARI.

III Agricultural Engineering

Major Fields : Farm Power and Equipment
Soil and Water Conservation Engineering
Agricultural Processing and Structures

Minor Fields : A student majoring in one of the above fields may elect to take a minor in another of these fields which are recognised as major fields for the discipline. But every student shall take not less than one minor (9 credits of course work) in another supporting major field from 6 disciplines such as :

- Agricultural Economics
- Agronomy
- Computer Application
- Environmental Science
- Genetics
- Plant Physiology
- Soil Science and Agricultural Chemistry
- Agricultural Physics
- Agricultural Statistics

DESCRIPTION OF COURSES

AE.125 Basic Electronics (2L + 1P)I

Fundamentals of emission, electron tubes, semiconductors and transistors, tube and transistor characteristics and circuits, power supplies, electrical and electronic measurement, A.C. and D.C. bridges, study and use of Oscilloscope, VTVM etc., electronic control and circuits, basic principles of digital circuits.

AE.126 Applications of Electrical Power in Agriculture (2L + 1P)II

Principles of application of single-phase and three-phase A.C. circuits, transformers and D.C. machines, switchgear and control equipment; principles of selection, installation and maintenance of electric motors and controllers, supply and distribution of electric power for agricultural products; processing and rural living, load survey, application of electricity for heating and lighting, electrical power for pumping for irrigation and drainage and material handling, illumination design for storage structures, poultry and farms, electric tariffs, safety measures in rural electrification.

AE.127 Operations Research (3L)I

Introduction to methods of operations research, formulation of problem and construction of models, inventory, allccation waiting time, replacement and competitive models, solution of models using Monte Carlo method, Poisson, Bernoulli, Markov Chains, Polya Contagion and other stochastic models, linear programming, implementation of solution, PERT and CPM.

(Pre-requisite : Some prior knowledge of statistics and differential calculus)

AE.128 Instrumentation and Research Methodology in Agricultural Engineering (2L + 1P)I

Parameters involved in agricultural engineering research. Planning and organisation of experiments for data acquisition and analysis. Measurement of variables. Multivariate analysis problems. Handling of variables as sub-systems of an integral system. Maximisation of function, algorithmic and dynamic programming. Stochastic process, simulation, measuring sensors and transducers.

AE.129 Dimensional Analysis and Similitude (2L)II

Scope of dimensional analysis, transformation of units of measurement, dimensional homogeneity, complete sets of dimensionless products, Buckingham's theorem, determinants; transformation of dimensionless products, similarity and model testing, dimensional analysis as applied to problems of stress and strain, fluid mechanics, heat transfer and electromagnetic theory. Differential equations and similarity.

(Pre-requisite : Knowledge of complex variable, matrices and differential equations)

AE.130 Engineering Properties of Biological Materials (2L + 1P)III

Organisation of plant body, cell wall and cell contents. Retention of water in biological products. Physical characteristics e.g., dimensions, density, volume, porosity and surface area. Concept of rheology. Rheological equation for stress and strain, visco-elastic characterisation of food materials, aerodynamic and hydrodynamic, thermal, electrical and optical properties. Application of engineering properties in engineering design.

AE.131 Environmental Engineering for Plants and Animals **(3L)I**

Variation of atmospheric pressure and temperature with height, energy transfer processes in the atmosphere and soil environment, electromagnetic wave spectrum, energy co-efficients, quantitative evaluation of energy balance equation, plant response to environmental factors, physiological and biochemical basis for responses of animals to climate. Engineering modification of environment.

(Pre-requisite : AE.230)

AE.209 Ergonomics **(2L + 1P)II**

Importance and scope of ergonomics in Indian Agriculture. Major human physiological systems and processes, work physiological concepts, physiological responses and indices, assessment of work performance. Anthropometry in the design of tools, equipment, controls and work space. Physical environment in relation to human performance and physical well being, its assessment and control.

AE.210 Advanced Stress Analysis **(3L)III**

Plane stresses, stress-strain relationship, equilibrium and compatibility equations, Airy's stress function, three-dimensional stress analysis, stresses in thick cylinders, elastic strain energy, theory of failures, shear centre, unsymetrical bending, curved flexural members, non-circular shafts.

AE.211 Theory of Vibrations **(3L)III**

Analysis of single and multiple degree of freedom system using Newton's law of motion, the energy method, Rayleigh's method, Lagrange's equation. The mechanical impedence method, influence co-efficient and matrices method. Introduction to transient vibration in a system using Laplace transform and vibration of continuous media.

AE.212 Theory of Elasticity and Application **(3L)II**

Equations of elasticity in two and three dimensions, two dimensional problems in polar and curvilinear coordinates. Torsion of non-circular shafts, bending of prismatic bars.

AE.213 Experimental Stress Analysis **(2L + 1P)II**

Experimental stress analysis method in agricultural machine design, electrical resistance in strain guage rosette, brittle lacquer, photoelastic method and photo-stress, testing techniques.

AE.214 Dynamics of Machinery **(3L)I**

Analysis of displacement, velocities, acceleration and forces in machine parts having reciprocating, rotating and combined motions, balancing fly wheels and vibrations in machines.

AE.215 Soil Dynamics (2L + 1P)II

Stress-strain relationship in soil, failure patterns, pulverisation, effect of speed, energy requirement and model simulations.

Relationship of soil parameters to forces acting on tillage tools, design of soil working implements.

(Pre-requisite : AE.223)

AE.216 Production Technology (2L + 1P)I

Theory of plastic properties and heat treatment of metals, press and press operations, theory and practice of welding, welding processes, metal cutting and machining process, jigs, fixtures and gauges, casting and die casting processes.

AE.217 Theory of Internal Combustion Engines (3L + 1P)II

Analysis of reciprocating engine cycle including thermo-dynamics and combustion and taking into consideration effects of fuel-air mixture, variable specific heats, chemical equilibrium and dissociation and heat losses, characteristics of fuels, combustion and knocking phenomenon, carburetion and injection, cooling and lubrication theory, testing of I.C. engines, performance characteristics with reference to farm tractors.

AE.218 Advanced Farm Machinery Design (2L + 1P)III

Principles of design and development of agricultural machines, Hydraulic and mechanical power transmission systems. Linkages on agricultural machines, safety devices on farm equipment. Design characteristics and force analysis of various soil working tools, Design standards and operation of seed drills and planters, Design and operation of machines for chemical plant protection, Design of forage, root crops and grain harvesting equipment, Design factors and equipment for threshing and winnowing of crops, utilization efficiency and performance of various agricultural machines.

(Pre-requisite : Farm Mechanics)

AE.219 Advanced Farm Power (2L + 1P)II

Human, bullock, I.C. engine and other forms of power. Analysis and testing of internal combustion engines specifically for use in farm tractors. Transmission, chassis and stability. Traction theory. Slippage and sinkage of wheels. Tractor test and test code. Power losses in the tractor, dynamometers and hydraulic equipment. Selection of tractor and power tillers with reference to land holdings. Power requirement for various farm operations. Utilisation and performance of power tillers.

(Pre-requisite : Farm Mechanics)

AE.220 Land and Water Management Systems Design (3L)II

(i) Introduction

(ii) Models and simulations :

- (a) Review of the different models (both deterministic and stochastic)
- (b) Production function
- (c) Simulation of system response
- (d) Micro-level optimisation
- (e) Macro-level optimisation
- (f) Results expected

(iii) Basic data

(iv) Case study

(Pre-requisite : AE.226,229)

AE.221 Groundwater Hydraulics and Development Technology (2L + 1P)III

Groundwater occurrence in India, types of aquifers, Geohydrological investigations, basic equations of groundwater flow, groundwater budget, different types of boundary conditions, flow in different types of aquifers, hydraulics of flow towards wells, aquifer tests, modelling, regional groundwater flow, finite difference and finite element methods, groundwater recharge, conjunctive use of groundwater with other sources of water.

AE.222 Open Channel Hydraulics (3L + 1P)I

Open channel flow and its classification, open channels and their properties. Energy and momentum principles, critical flow, its computation and analysis, uniform flow and its computations, concepts of boundary layer, surface roughness, velocity distribution and instability to uniform flow. Theory, analysis and methods of computations of gradually varied flow. Hydraulic jump, gradually varied and rapidly varied unsteady flow.

AE.223 Soil Mechanics (3L + 1P)I

Physical and engineering properties of soils. Stress, deformation, shear strength, consolidation, stability and compaction, gradation, moisture content, compaction of soils for earth dams, embankments, piles, foundation and walls theory. Pressure distribution diagram. Earth pressure theory, retaining walls, forces acting on earth retaining structures, lateral earth pressures, Coulomb's earth pressure theory, assumptions and deficiencies, active and passive earth pressures, bearing capacity of soils, stability requirements of a foundation, soil rating, soil loading tests, Housel's bearing capacity method, perimeter-area ratio method. Settlement and lateral expulsion of soils.

AE.224 Administration and Operation of Land and Water Resources (2L)II

Competition for use of water for domestic water supply and sanitation, hydroelectricity, flood control, navigation, mining and industrial uses, fisheries and irrigation. Systems approach to allocation of water use for maximum economic efficiency in development of a region. Legislation of water rights. Various systems of administrating technical and legal operations. Laws in India. Methods of distribution-measurement, regulation of flows, conservation and reuse of water. Water purification and filtration systems. Financing of water resource development and utilisation.

Work and laws of tenancy, land use and ownership. Land reforms and its scope. Other systems of ownership, tenancy and working of land for agricultural production.

AE.225 Advanced Hydrology (3L + 1P)II

Mathematical modelling of hydrologic processes—precipitation, infiltration, evapotranspiration, runoff, soil water balance, Probabilistic analysis of rainfall for irrigation scheduling, Rainfall—runoff relationships, Analysis of hydrographs, Watershed modelling, Frequency analysis for design of hydrologic systems. Time series analysis for hydrologic design and forecasting.

AE.226 Farm Drainage Systems Design (3L + 1P)II

Hydrologic basis for drainage systems design, occurrence of floods, stochastic derivations of peak flows. Analysis of flow into and through soil upto effective root-zone depth. Types of drains. Surface drainage systems. Sub-surface drains in homogeneous isotropic soils and anisotropic heterogeneous soils. Conveyance of drainage water compatible with irrigation system. Computational analysis for solution of flow and draw-down problems. Basis of drainage coefficients and degree of drainage desirable. Drainage structures. Design, layout and construction of farm drainage systems considering rainfall, topography, soil and crops. Gravity-cum-pump drainage systems. Macro-drainage system considerations in design. Outlet considerations. Legislation involved.

AE.227 Fluid Mechanics (3L + 1P)I

Review of fluid properties and definitions. Fluid flow concepts and basic equations. Kinetics and dynamics of fluid flow, method of describing motion, velocity, acceleration, Euler's equation, stress and deformation components for general cases. Fundamental equations derived from principles of mass transfer and conservation of mass, momentum and energy. Ideal fluid flow requirements, vortex, irrotational and rotational flow, velocity potential, stream function, flow net, two and three dimensional flow. Boundary layer theory, velocity distribution, transition from laminar to turbulent flow, Heleshaw models.

AE.228 Flow Through Porous Media (2L + 1P)III

Physical and chemical properties of the medium and the fluid. Theories of saturated flow. Confined and unconfined flow phenomena and analysis. Steady and unsteady flow phenomena and analysis. Classical capillary models, parallel, serial and branching types of models, Hogen, Poissenlls, Iberal, Gibbs theories, Venzol's model, diffusion theory, Phillips equation and Muskat models.

AE.229 Irrigation Systems Design (3L + 1P)II

Development of minor irrigation supply from flowing, stored, surface and sub-surface sources. Design of systems for direct pumping from flowing streams, small reservoirs, surface wells and tubewells. Design with constraints of water-supply, funds, materials and equipment. Economic efficiencies in supply of irrigation from various sources. Application of water lifts and pumps for irrigation. Design of conveyance through open channels, pipes and through distribution systems. Water conveyance structures. Irrigation scheduling and depth application in relation to various soil and plant variables. Consumptive use principles. Water distribution and measurement methods, structures and equipment. Surface, sub-surface and overhead application methods and variables involved in efficient application. Design, construction and layout of various irrigation systems for watersheds and individual farms compatible with conservation and drainage systems. Types of sprinklers and sprinkler irrigation systems, sprinkler patterns, uniformity of coverage, design and operational features. Hydraulic design of system pump plant design; special uses, economics of design. Cost benefit analysis.

AE.230 Heat and Mass Transfer (3L)I

Modes of heat and mass transfer. Uni and multi-directional heat conduction. Principles of convection, boundary layer and turbulence, momentum and energy equation. Radiative heat transfer. Heat and mass transfer analogy. Molecular diffusion of fluids. Mass transfer operations : absorption, adsorption, extraction—exchange and leaching.

AE.231 Drying and Dehydration (2L + 1P)II

Kinetics of moisture sorption and desorption, mechanism of moisture transport, theory of drying, drying rate calculation, methods of drying grains, seeds and forage crops. Dehydration techniques for different food products. Effect of drying and dehydration on physico-chemical compositions.

AE.232 Design of Storage Structures (1L + 1P)I

Storage losses of food materials due to micro-organisms, enzymes, moisture, and insects. Treatments of agricultural products for longevity in storage. Equilibrium moisture content, moisture migration. Design of fans and aeration ducts. Different methods of storage, basic principles in design of grain storage structures, effect of friction, pressure distribution and flow characteristics. Salient features in design of cold storage structures.

AE.233 Design of Processing Plants (3L)II

Raw food materials, harvesting, handling and packaging of raw materials, unit operations in processing plants, plant layout and its evaluation, salient features of processing plants for cereals, horticultural crops, poultry and meat products, guidelines for design and cost analysis of processing plants.

(Pre-requisite : AE.230)

AE.234 Unit Operations in Agricultural Process Engineering (3L)III

Size reduction, sorting and grading, threshing, dehusking and milling, principles of cleaning, aspiration and elutriation. Materials handling devices and their operational features, packaging machinery and materials.

AE.240 Rural Water Supply and Sanitation (2L + 1P)III

Importance of rural water supply and sanitation system, sources of rural water supply, domestic water requirements, water distribution system. Surface and sub-surface drainage, microbiology of sewage, sewage disposal and treatment, environmental sanitation and control.

AE.241 Norms of Rural Planning (2L)I

Importance and scope of rural planning, present status. Objectives of rural planning, location and layout of rural houses, public buildings, animal houses, roads. Rural water supply and sanitation system, integrated rural infrastructural facilities. Socio-economic factors governing rural planning.

AE.242 Farm Structures and Animal Housing (2L)II

Types of farm structures and animal housing. Design of farm structures. Environmental control in farms, livestock buildings and storage structures. Selection of material and equipment.

AE.243 Advanced Structural Analysis (2L + 1P)II

Theory of plastic design, ultimate load theory. Moment at failure of beam, Whitney's theory of ultimate strength, yield line theory and their application, structural behaviour of shell type structure, specific shear, design of shell roof, membrane theory, edge disturbance, experimental stress analysis, design of steel structures, plate girder, built up beams etc.

(Pre-requisite : Theory of structures in elastic equilibrium and design of R.C.C. structures)

AE.244 Advanced Reinforced Cement Concrete Design (2L + 1P)III

Reissener's method of design of R.C.C. tanks, supporting tower for circular tank, rectangular tank, underground tank, stresses under own weight, water earth pressure and external loads.

Advantages of prestressing types. Freyssinet's system. Magnel system, Lee-Macall system, electrical prestressing, precast unit, loss prestress materials used in prestressing, fire resistance, design of beams, bending of cables, end blocks, testing of pre-tensioned beam, shear and bond stress, ultimate strength.

(Pre-requisite : Basic knowledge of R.C.C. design and pre-stressing)

AE.245 Numerical Methods in Field Flow and Heat Transfer (2L + 1P)II

Review of governing equations and their classification, discretisation procedures, stability, consistency, convergence, alternative methods, problem formulation, applications for steady state and time dependent problems.

AE.251 Soil and Water Conservation Engineering **(3L)I**

Concepts of Soil and Water Conservation; relevance of soil water conservation in agriculture; productivity loss due to soil erosion; moisture stress and moisture excess.

Types of soil erosion, Mechanics of water erosion of soil; effect of land preparation and cultivation practices on soil erosion, theories of sediment yield and sediment transport; bed load movement; measurement of sediment yield and sediment transport; effective life of dams and water detention structures, effect of soil erosion on the life of multipurpose river valley project; soil erosion and loss of fertility, erosion in water conveyance system; design of channel for erosion control, tractive force theory, maximum permissible velocity, hill soil erosion, land slides, mechanics of wind erosion, types of wind erosion and soil movement, wind erosion control measures.

Analysis of hydrologic data, including rainfall, evapotranspiration, watershed characteristics; overland flow; methods of estimation of run off, peak rate and time distribution of hydrograph, synthetic hydrographs, infiltration process, hydrologic evaluation of land treatment; flood routing.

Erosion control, design of soil conservation structures, farm ponds and temporary storage reservoirs, drop structures, chute spill ways and temporary storage reservoirs, small earth dams, afforestation and associated agronomic practices.

The role of river valley projects, soil conservation department, Directorates of Agriculture and Agricultural Engineering, CADA, etc. in undertaking soil and water conservation works, the role of farmers in soil and water conservation works, research done and further needs.

AE.299 Seminar

Core Courses :

(A) For M.Sc.

- (i) Within the discipline : AE.128 and AE.129.
- (ii) Outside the discipline : AS.111, AS.150, CS.112 and AS.121.

(B) For Ph.D.

- (i) Within the discipline : AE.127, AE.129.
- (ii) Outside the discipline : CS.112, AS.121.

IV Agricultural Extension

Major fields : Agricultural Extension
Agricultural Communication
Rural Sociology
Home Science Extension (for M.Sc. only)

Minor fields : A student majoring in one of the above fields may take a minor in the other field recognised as a major in the discipline except Agricultural Extension but every student shall take not less than one minor (9 credits of course work) in another supporting major field from disciplines such as :

Within the discipline : Educational Psychology

Outside the discipline : Agricultural Economics
Agricultural Statistics
Agronomy
Environmental Science
Horticulture
Microbiology

DESCRIPTION OF COURSES

Ag.Ext.100 Fundamentals of Extension Education (2L + 1P)I

Theory : Basic aim of education and its implications to Extension Education; growth of Extension Education—its scope, problems and challenges; a critical review and analysis of definitions, objectives and philosophy of Extension Education; conceptual and philosophical similarities and differences between Extension Education and Community Development, Extension Education—its body of knowledge, nature and type of extension services; Extension Education as discipline and profession—its relationship with subject matter fields and allied social sciences; extension role of agricultural university; integrated functioning of teaching, research and extension; a comparative study of Extension Education systems in selected developed and developing countries and research studies in Extension Education.

Practical : Study of the working of C.D. Blocks of Delhi territory; visit to selected Agricultural Universities/Institutes to study their extension activities.

Ag.Ext.101 Extension Teaching Methods and Audio-Visual Aids (2L + 2P)II

Theory : Concept and characteristics of teaching and learning process in Extension Education; basic principles of teaching and learning; attribution, classification and steps of extension teaching methods with special emphasis on group discussion, demonstration, field days and public speaking; principles of selecting effective combinations of extension teaching methods; role of audio-visual aids in making extension teaching effective; types of audio-visual aids; combining and using audio-visual aids for effective teaching; principles and process of production of audio-visuals; studies on extension teaching methods and audio-visual aids.

Practical : Using different extension methods in field situation/farm and home visits, method demonstration, visit to extension/field programme, national demonstration and use of farm literatures; preparation of various visual-aids, posters, charts, flash cards and flannel graphs; handling projection equipments.

Ag.Ext.102 Fundamentals of Rural Sociology (3L)I

Theory : Rural sociology and its relationship to other social sciences with special reference to Extension Education; historical development of Rural Sociology; concept of human society—functions and characteristics with special reference to rural area; characteristics of rural people; theory and principle of social structure—social institutions, social organisations and groups; social stratification, rural value systems; social interactions and processes—cooperation, accommodation, assimilation, competition, conflict and rivalry; concept and forms of culture—its implications in extension work; process of socialisation; social change and social reorganisation; analysis of social systems—Loomi's model.

Ag.Ext.103 Psychology of Human Behaviour (3L)II

Theory : Psychology as scientific study of behaviour—its scope and importance in extension work; three dimensions of behaviour—cognitive, conative and affective; subjective and objective methods of studying behaviour of rural people; sensation—meaning and kinds; perception—nature and principles of perception and its implications in educating farmers; concept formation—its theories and their applications in developing concepts and ideas; theories of learning, principles and practices of effective adult learning, emotion—its nature, types of emotional response and their roles in regulating human behaviour; attitude—its meaning, characteristics and assessment; motivation—its nature, type of human motive and techniques of motivating farm people for adoption of innovations.

Ag.Ext.104 Photography (1L + 1P)III

Theory : Theory and principles of photography; role of photography in extension; types of camera and their use; essentials of a camera; taking indoor and outdoor pictures; type of films; darkroom and its requirement, choice of papers; developing agents and their preparation, printing, and enlarging of photographs, copying of photographs; coloured photography—tonning, production of black and white; coloured slides—mounting and display of photographs; story telling pictures.

Practical : Handling of camera and taking photographs; preparation of developers; developing and printing; planning, designing and preparing filmstrips and slides.

Ag.Ext.105 Women and Child Welfare in Rural Development (2L + 1P)III

Theory : Role of women in the family—health and nutrition, family relationship, family occupation; influence of taboos, mores, values, beliefs and such other factors on women's roles; child rearing patterns in rural society—personality development of the child, health and nutrition implications existing Home Science Extension Programmes and organisations—farm women's training, applied nutrition programmes, integrated women and child development, Balwadis, Mahila Mandals; development and utilisation of rural women's leadership; extent, scope, and implication of women's employment in family welfare; problems and challenges in Home Science Extension Programme.

Practical : Visit to blocks and other development organisations to acquaint students about the on-going programmes; field observations of programmes; and case studies of selected Balwadis and Mahila Mandals.

Ag.Ext.106 Process and Media of Agricultural Communication (3L + 1P)I

Theory : The nature and importance of agricultural communication; models of communication and its elements—factors affecting fidelity; feedback—importance and effects; communication and learning—the similarity of the process; media of communication—mass, group, traditional, and inter-personal—their types, roles and functions; social psychological approach to mass and inter-personal communication; farm information method—publicity, propaganda and education; communication and social change; barriers of communication—social, cultural and psychological; communication strategy for agricultural development; significant researches in communication and their implications.

Practical : Visits to :

(a) Villages for the study of media impact

(b) Farm Information Unit, A.I.R.

(c) "Krishi Darshan" Programme, T.V. Centre, Delhi

(d) Press Trust of India

(e) Indian Institute of Mass Communication, Delhi.

Ag.Ext.200 Planning and Execution of Extension Programmes (2L + 2P)II

Theory : Historical perspective of programme planning in India, the nature and importance of extension programme planning; principles and process in developing sound extension programmes; concept of total extension programme; different types of plans; programme development as a social action process; organisational structure for planning at various levels; role of extension agency, local leaders and institutions in planning and execution of extension programmes; role of Planning Commission; process of developing Five Year Plans in India; agricultural development programmes—I.A.D.P., I.A.A.P., H.Y.V.P., Multiple Cropping Scheme, Small Farmers Development Agency, Marginal Farmers and Landless Labourers Project, Dry Land Farming, Integrated Area Development Programme, National Demonstration Scheme, Animal Husbandry and Dairy Development Programme, I.R.D.P. & T&V system.

Practical : Preparation of different types of plans; evaluation of a prepared village or block plan : visits to selected districts, blocks and villages to see the actual working of some of the developmental programmes in action.

Ag.Ext.201 Methods of Social Research and Evaluation (3L + 1P)II

Theory : The meaning and purpose of social research and evaluation in social science; social research and evaluation—scientific approach to study of problems; process of scientific research—selection and formulation of a problem; hypothesis—meaning, types of hypothesis and its testing; nature and types of variables—independent, dependent and intervening; social research design—ex-post-facto, field experiment and survey research; method of study of data collection—questionnaire, schedule, observations and case studies; validity and reliability; concept of measurement; techniques of tabulation and analysis of data; report writing; recent trends in social science researches and evaluation.

Practical : Each student will identify a research/evaluation problem and will be required to use all the steps in conducting research/evaluation including writing of the report.

Ag.Ext.202 Rural Community Organisation and Leadership (3L + 1P)III

Theory : Rural community organisation—meaning, concepts and assumptions; process of community organisations; fundamentals of creating a progressive rural community structure; basic rural institutions—school, panchyat, cooperatives, banks, etc., and their role in rural development; concept and theories of leadership; scope, role and importance of local leaders in agricultural and community development; characteristics and types of leaders; methods of identifying leaders; basic pattern of leader—group relationship in rural society; leadership training; implications of research studies in the area of leadership and community organisation.

Practical : Process of organising community organisations around selected innovation; identification of effective leaders and pattern of leadership.

Ag.Ext.203 Training and Management for Agricultural Development (3L + 1P)I

Theory : Concept of training and education—their inter-relationship; types of training; factors affecting training; current trends in training—organisational development approach etc.; conceptual models of training; training strategy, methods and designs; conducting and evaluating the training programme; follow up; training facilities available in India for different categories of extension personnel.

Personnel Management—definition, scope and approaches; learning and dynamics of human behaviour; theories of personnel management; determining personnel needed by an extension organisation—competencies needed by extension personnel; systems of selection and factors involved in selection procedures; effective management of extension personnel—personnel appraisal, incentives, promotions, transfers, working facilities, terms of employment, intellectual flexibility etc.; moral—definition, components and maintenance; human relationship in agricultural development—theories and practices.

Practical : Organising training sessions using different training techniques; visits to training institutions to share their experiences. Visiting development organisations to share their experience on human relation and personal management.

Ag.Ext.204 Dynamics of Change (2L + 1P)II

Theory : Dynamics of change—concept, importance and implications; personality/group/community as a dynamic system; typology of change—planned, indoctrinated, technocratic, coercive, emulative etc.; theories of change—Darwin's, Kurt Lewin's, Ogburn's etc.; process of change and phases involved therein—unfreezing etc.; change agent's role—assessment of client system's motivations and capacity to change, assessment of resources, fixation of change—objectives, creating suitable environment, provision of technical know-how and moral support, evaluating change—effects etc.; stimulants to change—psychological, social, economic etc.; studies in dynamics of change.

Practical : Introduction of an innovation if possible, during the period and studying clientele's reaction in terms of models of change; identification of barriers and stimulants existing in a rural community towards an introduced change/conducting study pertaining to change in rural community living.

Ag.Ext.205 Group Dynamics and Human Relation (2L + 1P)III

Theory : Group dynamics—concept and theoretical orientations; small groups—their characteristics and importance in rural development; process of interaction in small groups, group interaction analysis; dynamising the group for effective participation in agricultural development programmes; methods of studying group dynamics; dialogue; group discussion—Huddle method and Buzz method, seminar, symposium, panel discussion, interrogator panel, committee hearing, small group participant observation, workshop, conference and role playing; organising and revitalising rural associations like Rural Radio Forum, Tele-club, Rural Women's club etc., Group norm—its meaning and implications for rural development work; group morale—its nature, different ways of raising the morale of farming community; prejudice in rural community and ways of removing them for effective group development; human relation—its concept, basic principles and implications in extension work.

Practical : Each student will be required to conduct rural group studies and submit report in any two of the following areas—small group interaction, study of Rural Radio Forum, Charcha-Mandal, Women's Forum (Mahila Mandal). Tele-club etc.; observational study of group work in small rural groups of farmers, social norm of a rural community, its morale, prejudices and human relation aspect.

Ag.Ext.206 Techniques of Farm Broadcasts and Telecasts (2L + 1P)II

Theory : Relationship between radio and television and other mass media, educational and informational roles of radio and television and its applicability to rural development programme; operational aspects of radio and television scripts; technique of interviewing, audience analysis; impact and feed back experience; evaluation of farm broadcasts; problems and trends in research in television and radio as effective mass media of communication.

Practical : Selection of technological themes for radio broadcasts and telecasts; writing scripts for radio and television for different types and modes of presentation; evaluation of radio programmes and telecasts specially Krishi Jagat and Krishi Darshan programmes; understanding of programme production at the A.I.R. and the Doordarshan, Delhi.

Ag.Ext.207 Rural Community Nutrition (2L + 2P)I

Theory : Nutrition and development; food and nutritional problems—economic, agriculture, population, socio-cultural, educational and environmental; nutritional status—a national picture; techniques for nutritional assessment—diet surveys anthropometrical measures, clinical and biochemical means; family nutritional principles and related factors—nutrition of vulnerable groups; diet for different income levels; weaning foods—concept, mixtures; food conservation—grain storage, processing, fortification and enrichment, programmes for nutritional improvement; nutrition education—goal, content, techniques and impact; supplementary feeding; researches in nutrition education and their implications.

Practical : Field visits to rural areas and urban slums to observe prevalent food and nutrition problems; laboratory work on development and preparation of foods for infants and pre-school children and testing their acceptance, food processing as applicable to rural homes; assessment of nutritional status of children, family diet surveys and other techniques.

Ag.Ext.208 Rural Home Management (2L + 1P)II

Theory : Concepts in the management of a home—rural family in changing India; philosophy, values, goal, principles and procedures in home management; women's role in task performance and decision-making; family relationship and home management; resources in home management—time and energy management; work study, work simplification techniques as applied in the home; housing pattern—structure, layout, drainage, sanitation, lighting, interior arrangements and their influence on home management; household equipments and efficiency; management of family finance.

Practical : Visits to rural homes to study housing facilities, observations on work patterns, work study; Introduction of selected innovations in rural homes.

Ag.Ext.209 Agricultural Journalism (2L + 1P)III

Concept of agricultural journalism and agricultural communication; agricultural journalism as means of mass communication—its form and role in rural development programmes; opportunities, strength and limitations in India; relations of press with government and society; readability of literature—genesis of readability tests; clarity and brevity in writing; principles and techniques of writing news stories, feature articles, magazine articles, farm bulletins and folders; fundamentals of layout—various elements and their balancing; techniques of editing; publishing a technical journal; research in agricultural journalism and its application.

Practical : Designing and layout—preparation of cover design for farm magazines, folders etc. and laying out inside material; processes of printing extension literature, news collection and reporting; writing magazines and feature articles and scripts of technical folders; technique of pretesting readability. Each student will select one form of publication and produce dummy designs and layouts.

Ag.Ext.210 Techniques of Research in Behavioural Sciences (3L + 1P)III

Theory : Role of measurement in social sciences; theory of scale development—validity and reliability; process and techniques of scale construction; various types of scales in Social Research; conventional and non-conventional scaling techniques : paired comparison, equal appearing interval, summated rating, scalogram analysis, projective and non-projective techniques, Q-sort techniques, group interactional techniques; utilization of these techniques in Extension Research—their advantages and limitations.

Practical : Cases and problems are provided for constructing different types of scales and techniques in the field and laboratory situations.

Ag.Ext.211 Extension Administration in Agriculture (3L + 1P)III

Theory : Extension administration—concepts, scope and characteristics; extension administration vs. general administration, historical perspective of agricultural administration with special reference to extension services, changes and implications; administration vs. management; administrative role, function and responsibilities; administrative processes, techniques and principles applied to agricultural organisations; coordination and supervision—techniques and principles; administrative theories and their implications; decision making and human relationships; administrative communication and analysis of research studies in agricultural administration and their implications to agricultural development and future researches.

Practical : Studying the organisation set-up of selected States and developing models of administrative set-up; organising visits to different types of organisations—government, private/ autonomous for studying their functions—specific merits or limitations.

Ag.Ext.212 Diffusion and adoption of innovation (3L + 1P) Biennial

Theory : Concept of diffusion and adoption—symbolic adoption and use adoption and its historical perspective; models and theories of adoption and diffusion; adopters categories and their characteristics—adoption curve and factors associated with adoption, adopters categories and sources of information category-wise and adoption stages; personal and social characteristics of the adoptors and non-adoptors; attributes of innovations as related to rate of adoption and sources of information; role of change agents in adoption and diffusion—their characteristics; clinetel systems and technology; consequences of adoption of innovations—economic, social and others; review of research—projection, implications and strategies.

Practical : Individual as well as group projects will be assigned to study some selected agricultural innovations accepted or rejected by the big, medium and small farmers. After a detailed study, the report will be presented and discussed.

Ag.Ext.299 Seminar **(1L)I & III**

Issues and problems in Extension and rural development with special reference to agricultural development.

Core Courses

(A) For M.Sc.

(i) Within the discipline : Agricultural Extension—Ag.Ext.100,200 & 211 (11Cr.)

(B) For Ph.D.

(i) Within the discipline—Ag.Ex.200,211 & 212 (12 Cr.)

Any other course recommended by the student's Advisory Committee in the discipline of Agronomy and Agricultural Statistics.

V Agricultural Physics

Major Field :	Agricultural Physics
Minor field :	In addition to the major field, every Ph.D. student shall take not less than two minor fields of study (one for M.Sc. students) with at least 9 credits of course work in each, in disciplines such as:

Agricultural Chemicals
Agricultural Engineering
Agricultural Statistics
Agronomy
Biochemistry
Computer Applications
Entomology
Environmental Sciences
Genetics
Horticulture
Microbiology
Molecular Biology and Biotechnology
Mycology and Plant Pathology
Plant Physiology
Soil Science and Agricultural Chemistry

DESCRIPTION OF COURSES

AP.105 Basic Concepts of Physics (4L + 1P) I

Mechanical properties; nomenclature; elasticity; hydrostatics; surface tension; hydrodynamics; viscosity; diffusion; osmosis; Brownain motion; Thermal properties: thermometry; calorimetrry; kinetic theory of gases, Boltzmann distribution; equation of state; heat transfer; iso-thermal and adiabatic processes; Wave nature: simple harmonic motion;

ultrasonic vibrations, interference and diffraction; lenses and aberrations; optical instruments; Magnetic and electric properties: magnetic field and potential; electric charges, field and potential; EMF, potentiometer and Wheatston's bridge; thermoelectricity; atomic structure and periodic classification; electromagnetic spectrum.

AP.110 Meteorology (2L) II

Sun and earth, seasons, Radiation: Planck's law and other laws. Green House effect; Albedo; Heat balance of the earth and atmosphere. Variation of pressure and temperature with height. Vapour pressure. Psycrometric equation. Saturation deficit, potential temperature, pressure gradient, cyclonic and anticyclonic motions. Clouds and their classification. Precipitation processes, artificial rain making, haze, mist, fog, dew, air masses and fronts; tropical and extra-tropical cyclones. Seasonal distribution of radiation, rainfall, temperature and wind. Weather charts, forecasting methods. Meteorological instruments.

AP.111 Climatology (3L) I

Weather and climate; Climatological elements; seasonal distribution over latitudes. Climatic classification, Koppen and Thornthwaite systems; humid and dry climates; continental, maritime and desert climates. Climatology of India: the monsoons; length of day, degree days, temperature; rainfall and its variability; arid and semi-arid regions; dust storms. Aridity and moisture indices; atmospheric and soil drought. Climatological factors—their effect on pests and diseases, crop growth and yield.

AP.120 Principles of Biophysics (2L + 1P) III

Elementary quantum mechanical concepts, wave-particle dualism; uncertainty principle; atoms and molecules; Pauli exclusion principle, types of binding forces; origin of life. Biophysical features of living cells; viruses. Biological molecules, their general character and structure. Bioenergetics; Survey of experimental techniques for study of biomolecules—diffusion, sedimentation, ultra-centrifugation, bi-refringence, light scattering, X-ray diffraction and electron microscopy, Phase contrast and interference microscopy. Ionizing radiations, their effects on living matter. Conduction of impulses by nerves.

AP.121 Techniques of Biophysics (2L + 2P) I

Isolation and purification of biological macromolecules and cell organelles-Sedimentation; ultracentrifugation, Electrophoresis Electrobiphosis, Chromatography, amino acid and nucleotide sequence analysis; Diffusion, Osomometry, Viscometry, Conductometry, Dielectrometry, Polarography, Micrcalorimetry; Microscopy—Polarised Light Microscopy, Phase contrast Microscopy, Interference Microscopy, Electron Microscopy; Light scattering, X-ray scattering, Electron scattering, Neutron scattering, optical rotatory dispersion and circular dichoism; Spectroscopy—UV, visible, I.R., LASER, E.P.R., N.M.R. and Mössebauer.

AP.130/SSAC.107 Fundamentals of soil Physics (3L + 1P) II

Scope of soil physics; soil as a disperse system; mechanical composition of soils; soil structure—classification, genesis, evaluation and agricultural significance; soil composition; soil crusting; soil water retention, movement of water under saturated and unsaturated conditions; infiltration; redistribution; evaporation; evaporation of water and its control; soil water balance; soil aeration and its characterisation; thermal regime of soil; soil consistency, plasticity, shear strength and soil tilth; physical properties of soils in relation to erosion and run-off; use of isotopes and radiations in soil physical investigations.

AP.153 X-ray Diffraction Analysis (2L + 1) II

Production of X-rays, their properties—absorption, scattering and diffraction; Crystal symmetry, crystal lattice, Miller indices, symmetry elements, point groups, space groups. Diffraction of X-ray by crystals, Bragg equation, reciprocal lattice concept, Laue, rotation, Weissenberg, fibre and powder methods. X-rays as analytical tool : qualitative and quantitative analysis of power patterns. Application of X-ray diffraction analysis to mineralogy, biology and industry.

AP.154 Electron Microscopy (2L + 1P) II

Electron and its wave nature, electron optics, aberrations of electrostatic and electromagnetic lenses, contrast and image formation: Electron microscope—its principles and construction. Methods and techniques for observation of specimens-ultra thin sectioning. Electron diffraction. Principles and image recording. Electron microscopy and nucleic acids, macromolecules. Principles of image reconstruction. Scanning and high voltage electron microscopy. Recent developments in the use of electron microscopy.

AS.155 Thermodynamics (3L) III

Thermodynamic state variables; different forms of energy; first law of thermodynamics, Carnot's cycle, concept of entropy. Second law of thermodynamics—scope and limitation, free energy and work function relationships. Chemical potential-Surface phase. Fugacity and activity; Nerst heat theorem, entropy and probability, Maxwell-Boltzmann energy distribution.

Non equilibrium thermodynamics; phenomenological laws; Onsager reciprocal relations. Changes across a membrane or porous plug. Soil water potential, hydraulic conductivity, Electrical phenomena—application to clay-water systems. Simultaneous movement of water, salt and heat.

AP.157 Nuclear Physics in Agriculture and Biology (2L + 1P) I

Discovery and constituents of nucleus. Nuclear forces and energetics. Radioactivity—law of radioactive disintegration, half life, radioactive decay and growth. Units of radioactivity. Interaction of radiation with matter. Detection and measurement of nuclear radiation. Detection and measurement of stable isotopes. Basic concepts of tracer methodology. Autoradiography. Application of radiosotopes and radiation in agriculture and biology. Nuclear techniques as analytical aids. Radiation protection.

AP.160 Agroclimatic Analysis (2L + 2P) I

Introduction to agroclimatological methods, characteristics of agroclimatic elements. Sampling of the atmosphere; time and space considerations, physical time lags, degree days, micro- meso- and macrometeorology. Network spacing. Instruments, sampling problems. Design of agrometeorological experiments. Computational aids, stream lines, trajectories, vector diagrams. Numerical characterisation of climatic features; climatic indices, moisture and thermal efficiency indices; spatial comparison of temperature; wind, humidity etc., synoptic methods; seasonal relationships. Dimensional analysis and modelling—climatological models for forecasting of pests and diseases. Methods of forecasting crop yields.

(Pre-requisite: AP.110 or AP.111)

AP.180 Soil Mechanical Impedance and Aeration (2L) III

Mechanical properties of soil as a deformable material. Stress-strain relationship. Soil strength and its measurement. Formation and effects of surface (crusts) and sub-surface (hard layer) impedances. Seedling emergence forces and their measurement. Physical measures (tillage etc.) to overcome soil impedance. Soil atmosphere—composition. diurnal and seasonal variation. Measurement and characterisation of soil aeration. Gaseous interchange—steady state and transient state diffusion in soils.

AP.181 Soil Structure and Micromorphology (2L + 1P) II

Structure of clay minerals, theories of electric double layer. Flocculation and gelation, edge-to-edge, edge-to-face association. Interaction of clays with water and organic compounds. Different forces within the aggregates—aggregate stabilisation. Three-dimentional build up of soil material. Soil structure and fabric. Units of organisation. Pedological features—cutans, glaebules etc., and their interpretation. Levels of organisation—plasmic structure, basic structure etc. Plasmic structure domains, morphological classification of typical model fabrics. Asepic and sepic plasmic fabrics—insepic, mosopic, mosepic, skelsepic, omnisepic and crystic. Sediments-strial fabric. Genesis and interpretation. Basic structure : plasma, skeleton grains and vois/vois size, shape, and arrangement-genesis and interpretation. Techniques in microscopic studies-micromorphometric examination of soil structure.

(Pre-requisite: AP.130).

AP.183 Principles of Remote Sensing (3L + 1P) II

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Basic components of remote sensing; signals, sensors and sensing systems. Active and passive remote sensing. Characteristics of electro-magnetic radiation and its interaction with matter. Spectral signatures of earth surface features. Remote sensors in visible, infrared and microwave regions. Farming and scanning systems; photographic cameras, spectro-radiometers, infrared scanners, microwave radiometer, imaging radars. Sensor platforms. Data acquisition system, ground truth and air-borne data collection, satellite image acquisition. Data collections; pre-processing and data storage. Remote Sensing data analysis; visual and digital image interpretation.

AP.209/SSAC.209 Advanced Soil Clay Mineralogy **(3L + 1P) I**

Detailed structure analysis and present status; structures of clay minerals; nomenclature and systems of classification; layer-charge relations among the clay minerals; structure, alteration and weathering of rock minerals; genesis and properties of soil clay minerals; weathering sequence of clay size minerals and frequency distribution, origin and properties of amorphous minerals of soils. Methods of study of clay minerals; quantitative mineralogical analysis. Laboratory quantitative clay mineral analysis of soils.

(Pre-requisite: AP.160 and SSAC.153)

AP.230 Soil Water **(3L + 1P) I**

Structure and physical properties of water, State of soil water, its retention by different forces, free energy concept of soil water. Soil-water interactions. Application: Poiseuille's law, Darcy's law, Laplace's equation in flow problems. Concepts of unsaturated flow and solutions to some unsaturated flow problems, infiltration, redistribution and evaporation of soil water application of irreversible thermodynamics to soil water movement. Simultaneous water and solute movement. Thermal regimes and soil water movement. Soil water balance, measurement of hydrophysical properties and their variability in the field, internal drainage and evapotranspiration.

(Pre-requisite: AP.130)

AP.233 Remote Sensing Techniques in Agriculture **(2L + 1P) III**

Spectral characteristics of vegetation, soil and water; influence of water status, nutritional status and disease. Temporal and spatial effects on the spectral characteristics of earth surface features. Crop stress detection. Canopy temperature and crop water stress. Crop discrimination and identification. Crop yield modelling, forecasting. Soil moisture assessment. Soil degradation- salinity, sodicity, water logging, soil erosion and conservation; land use inventory and planning.

(Pre-requisite: AP.183)

AP.234 Remote Sensing and Environment **(2L + 1P) I Biennial (Even Years)**

Remote sensing techniques in weather forecasting, temperature and precipitation estimation, monitoring adverse weather for crops; use of remote sensing for water resources inventory-groundwater, snow and ice covers; water quality monitoring; flood mapping; inventories of resources, forest mapping; geological mapping; desert areas and soils.

(Pre-requisite: AP.183)

AP.310 Evapotranspiration **(3L + 1P) III/Biennial (Even Years)**

Basic laws of radiations; interaction and plant environment; energy balance in atmosphere-crop canopy; the atmosphere near the ground. Theories of evapotranspiration and their comparison. Application under different agroclimatic conditions; potential and actual evapotranspiration-influence of micro-climatic, plant, soil and cultural factors. Techniques of lysimetry in measuring actual evapotranspiration. Yield functions; water use efficiency and irrigation scheduling based on evapotranspiration. Advanced techniques for measurement of radiation and energy balance.

(Pre-requisite: AP.110)

AP.311 Micrometeorology **(3L + 1P) III/Biennial (Odd Years)**

Properties of atmosphere near the earth's surface, frictional effects, eddy—diffusion; mixing: temperature instability, air pollution; Microclimate near the bare ground, unstable and inversion layers, variations in microclimate under irrigated and rainfed conditions. Micrometeorology of plant canopies; distribution and temperature; humidity; vapour pressure, wind and CO_2. Radiation distribution utilisation by plant communities-leaf temperature and its biological effects. Influence of topography on microclimate. Instruments and measuring techniques in micrometeorology.

(Pre-requisite: AP.110)

AP.320 Molecular Biophysics **(3L + 1P) II**

Functions of biological macromolecules and their organised structure. Biophysics of nerves, muscles and membranes, bioenergetics; enzymes kinetics; absorption of electromagnetic and ultrasonic energy by cells and tissues. X-ray analysis of biomolecules. Absorption spectroscopy and molecular structure. Action spectra and quantum yields; photosynthesis. Physics of cellular processes. Action of ionizing radiations on biomolecules—their use in cell structure study. Modern physical techniques for study of biomolecules and systems. Information theory. Genetic code.

(Pre-requisite: AP.120)

AP.331 Ionic Migration through Soil **(3L) I**

Physical principles of transport of water and nutrient ions; transport by molecular motion-cation, anion and salt diffusion; transport in laminar flow-misible displacement, dispersion, and mass flow; transport with more than one variable-equation of continuity, transport state, simultaneous movement of water, nutrient and salt; transport in large flow systems-source to sink transport, plant uptake and root interception; overview of similar processes-fertilizer and pesticide movement. Models for field solute transport.

AP.332 Soil Physical Environment and Plant Growth **(4L) III**

Seed water uptake and diffusivity; root development and distribution; soil structure in relation to soil erosion, moisture conservation, water repellency and plant growth; crop response to water under adequate and limited supply conditions; field water balance and water use efficiency; soil water management; nutrient availability and uptake; influence of soil temperature and aeration on crop growth and their management in soil-plant-atmosphere system; plant water status and transpiration; physical properties of problem soils, their improvement and management.

AP.299 Seminar (1L)

Core Courses

(a) AP.105 will be core course for all agricultural graduates.

(b) for M.Sc. AP.111, AP.120, AP.130 and AP.183.

(c) for Ph.D.: AP.111, AP.120, AP.130, AP.155 and AP.183.

VI Agricultural Statistics

Major fields : Sampling Techniques
Design of Experiments
Genetical Statistics.

Minor fields : A student majoring in one of the above fields may elect to take a minor in another of these fields. He would ordinarily, however, select one minor from courses other than those listed above and in any case would normally take atleast 20 per cent of the course work in fields other than those listed above such as:

Agricultural Economics
Agricultural Extension
Agronomy
Entomology
Environmental Science
Genetics
Horticulture
Soil Science and Ag. Chemistry

A student registering for M.Sc. in Ag. Stat. is required to undertake a minimum of 55 credits of course work of which atleast 9 credits should be outside the field of Ag. Stat. Besides the course work, he/she is also required to undertake a research problem and submit a report on the basis of the findings. The Ph.D. credit requirements are the same as in other disciplines. In addition, students who did not have maths as main subject at Bachelor's level shall undergo a series of remedial courses in mathematics.

DESCRIPTION OF COURSES

AS.100(A) Elementary Mathematical and Statistical Methods in Genetics (4L+1P)II

Permutations and combinations, logarithmic and related functions. Equation-simple, quadratic and others. Algebraic operations with series Periodic functions. Graphical methods. Limits. Differentiation and integration. Maxima and minima. Sets, vectors, determinants, and matrix. Probability-addition and multiplication theorems. Distributions-Chisquare, Binomial, Poisson and Normal. Analysis of variance and covariance, t and F test of significance. Regression and correlation. Elements of Computer use and programming.

Remedial Maths I/AS.101 Differential and integral Calculus (4L) I

Limits, Continuity and derivability, differentiation of functions of a single variable, successive differentiation. Use of Taylor's and Maclaurins' theorem. Mean value theorem.

Tangent and Normal, Asymptotes, Curvature, Points of inflexion. Hadel equation. Partial differentiation, Maxima and Minima of functions of single variable.

Integration by simple methods, standard forms, simple definite integrals. Reduction formulae, rectification and quadrature. Simple differential equations and their solutions. Beta and Gamma Functions.

Remedial Maths II/AS.102 Coordinate Geometry (Two and Three Dimensional) (3L) II

COORDINATE GEOMETRY IN TWO DIMENSIONS

Equations of a line, circle, parabola, ellipse and hyperbola, tangent and normal, Change of axis. Locus.

COORDINATE GEOMETRY IN THREE DIMENSIONS

Equations of plane and straight line. Distance of a point from a line and plane. Shortest distance between two skew lines. Spheres, cone and cylinder.

Remedial Maths III/AS.103 Real and Complex Analysis and Maxtrix Algebra (3L) III

Limits and continuity, differentiation and integration of functions of one or more variables, maxima and minima of functions, Convergence and uniform convergence of infinite series. Use of comparison test. D'Alembert Ratio-test, Cauchy Root Test, Raabe's Test, etc. for convergence of infinite series.

Complex variables and their geometric representation, functions of complex variables, De-Moivre's Theorem. Circular functions and their expansions, complex integrations, Cauchy's theorem and theorem of residues. Line and surface Integrals, Multiple Integrals.

Matrix algebra, elementary operations, equivalence, inverse matrix, linear and quadratic forms, transformations, characteristic equations, quadratic forms, determinants.

AS.108 Elementary Mathematical Methods in Economic Analysis (3L) I

Sets, set operations, kinds of sets, functions and geometric forms, limits and continuity of functions, derivatives, interpretation technique, applications, second derivative, maximum and minimum values, inflexion points, functions of two or more variables, logarithmic functions, elements of trigonometric functions, partial derivatives, homogeneous functions, Euler's theorem, linear homogeneous production function; differentials and differentiation techniques.

Integration technique, multiple integrals, geometric series, Taylor's theorem, differential equations, solutions, first and second order equations; difference equations, homogeneous and non-homogeneous linear difference equations, first and second order equations.

AS.109 Advanced Mathematical Methods in Economic Analysis (3L) I

Vectors, vector spaces, linear dependence, Matrix, elementary operations. Matrix algebra, equivalence, determinants, inverse matrix, linear and quadratic forms; transformations, characteristic equations of square and similar matrices; non-negative quadratic forms-partitioned forms.

Maxima and minima of functions; differentiation of a determinant solution of simultaneous linear equations, stability conditions.

(Pre-requisite: AS.108)

AS.110 Real and Complex Variable and Vector Spaces (4L) I

Fundamental notions of limits and continuity, differentiation and integration of function of one or more variables, maxima and minima of functions, convergence and uniform convergence of infinite series, line and surface integrals.

Complex variables and their geometric representations, functions of complex variable, conformal mapping, finite differences. Complex integrations, Cauchy's theorem and theorem of residues. Matrices and vector spaces.

AS.111 Differential and Integral Equations and Transforms (4L) II

Systems of differential equations including series solutions, partial differential equations. Heat and Laplace equations. Fourier and Laplace transforms, Eigen value and boundary value problems. Integral equations and calculus of variations, numerical integrations, numerical analysis, graphical techniques applicable to empirical data.

AS.120 Elementary Statistical Methods-I (1L + 1P) I

Tribhuwan Rai

Scope of statistics as a science of methods. Frequency distributions-histograms and frequency polygons, ogives etc., binomial distribution, normal curve. Concept of a random sample-drawing a random sample, estimation of mean, variance and standard error. t and F tests of significance. Analysis of variance x2 test-simple applications, linear regression-prediction equation. Scatter diagram and correlation table, co-efficient of correlation.

AS.121 Elementary Statistical Methods-II (3L + 2P) I & II

Scope of statistics as a science of methods. Frequency distribution-histograms, frequency polygons, frequency curves, ogives etc., measures of average and variations. Concept of probability, binomial distribution. Normal curve. Concept of a random sample, standard error of a statistics, concept of large sample theory, t and F tests of significance. Chi-square test and simple application. Analysis of variance. Linear regression prediction equation. Scatter diagram and correlation table, co-efficient of correlation. Multiple regression. Test of significance of regression and correlation. Fitting of quadratic and logistic curves. Confidence interval.

Sampling versus complete enumeration. Simple random sampling, Choice of strata. Choice of sampling units. Sampling and non-sampling errors.

AS.122 Elementary Design of Experiments-1 (2L + 1P) II

Principles of experimental design, replications, randomisation and local control. Completely randomised design and latin squares-procedure of randomisation in each case. Analysis of variance and interpretation of data. Size and shape of plots. Factorial experiments- main effects and interactions. Split-plot experiments. Missing plot technique in simple randomised blocks and latin squares.

Sources of official agricultural statistics and their limitations.

(Pre-requisite: AS:120)

AS.123 Elementary Design of Experiments-II (3L +2P) II

Principles of experimental design. Theory and practical of elementary designs such as CRD. RBD, latin square, split plot, BIBD etc. Analysis of variance and its interpretation. Missing plot technique, analysis of covariance, transformation of data. Sampling in field experiments and experiments on cultivator's fields.

(Pre-requisite: AS.121)

AS.124 Elementary Design of Experiments-III (1L + 1P) III

Uniformity trials. Concept of confounding-application in 2^n and 3^n experiments. Analysis of qualitative-cum-quantitative experiments. Combination of results of groups of experiments.

Response curves-economics of manuring. Elementary principles in planning long term and rotational experiments. (Pre-requisite: AS.121 and 123)

AS.125 Elementary Biometrical Methods (1L + 1P) III

Reproduction and mortality rates and their estimation. Techniques for estimation of population number and its growth. Poisson, negative binomial and long-normal distributions and their applications. Bioassay probit analysis.

Planning field experiments for study of pests and diseases and their control. Assessment of incidence of pests and diseases and the damage due to them.

(Pre-requisite: AS.120 & 122)

AS.126 Elementary Genetical Statistics (2L + 1P) III

Addition and multiplication probabilities. Detection of linkage. Estimation of linkage from back cross data and F2 and F3 data, methods of maximum likelihood and other methods of estimation. Disturbed segregation.

Inheritance of characters showing continuous variation. Mendelian basis, cumulative effects of genes-polygenic characters. Estimation of additive genetic, dominance and environmental components of variation Tests for linkage and epistatis. Correlation between relatives in randomly breeding population.

Plant breeding trials, replicated progeny rows, compact family blocks and their uses in the estimation of genetic variability. Simple ideas of use of discriminant function for plant selection.

(Pre-requisite: AS.121 and 125)

AS.127 Elementary Probability Theory (2L) III

Addition theorem, conditional probability, multiplication theorem, statistical independence. Mathematical expectation. Tchebycheff's inequality. Law of large numbers. Distribution function, moment generating function, characteristic function, continuity theorem on characteristic functions. Central limit theorem.

(Pre-requisite: AS.100, 101 and 102)

AS.128 Elementary Statistical Inference and Multivariate Analysis (2L + 1P) III

Estimation-consistency, unbiasedness, efficiency and sufficiency, maximum likelihood method, method of moments, minimum Chi-square, combined estimation, information, interval estimation.

Two kinds of error in testing hypothesis, uniformialy most powerful tests. Neyman-Pearson's lemma, derivation of t and F tests for normal population, likelihood ratio test.

Analysis of variance in hierorchical and cross-classification, intra-class correlation.

Applications of multivariate analysis. Discriminant analysis. Principal component and canonical correlations.

(Pre-requisite: AS.103, 121, 123 and 127)

AS.129/CS.112 Programming Language-Basic and Fortran 77 (2L + 1P) II

Data Types, Assignment, Control, Input/Output Statements. Sub program and Programme structuring statements.

AS.130 Statistics for Social Sciences (3L + 1P) II

Place of statistics for Social Sciences Research; frequency distribution, principles governing their formation and standard distributions; concept of sampling; simple random sampling, choice of strata, sampling and non-sampling errors. The concept and levels of measurement; statistics for various distributions; distribution free statistics-sign test, Wilcoxon matched pairs, signed rank test, Mann-Whitney U test. Wald-Wolfowitz run test, H-test, median test etc. Multiple regression and prediction equations. Application of multivariable analysis; factor analysis, rotations, factor loadings and their interpretation. Discriminant function and D^2 statistics. System analysis technique.

AS.150 Advanced Mathematical Methods in Statistics-I (3L) I

Linear Algebra: Vector spaces, Subspaces and basis. Linear transformations. Gram-Schmidt orthogonalisation. Matrices-symmetric, Orthogonal and other types, Characteristic roots of a matrix, Rank and inverse of a matrix, Generalized inverse of a matrix. Quadratic forms.

Real Analysis: Convergence and uniform convergence. Continuity and differentiability. Mean value theorems of differential and integral calculus. Taylor's expansion with remainder term. Riemann integration. Maxima and minima.

Differential Equations: Equations of the first order-Clairat's form. Linear differential equations with constant co-efficients.

AS.151 Advanced Mathematical Methods in Statistics-II (3L) II

Real Analysis: Concept of Lebesgue integration. Power series. Fourier, Laplace and Laplace-Stieltje's transforms. Multiple integrals.

Complex Analysis: Complex numbers. Analytic functions Cauchy-Riemann equations. Singularities. Residues and Contour integration.

Numerical Mathematics: Operators, E, S. Simple interpolation. Numerical differentiation and integration, Euler-Maclaurin formula, Newton-Raphson method.

AS.160 Probability (3L) I

Elements of measure theory. Probability-classical and frequency definitions. Axiomatic approach-conditional probability and laws of probability. Bayes's theorem. Random variables-discrete and continuous. Mathematical expectation and its laws. Distribution, density, characteristic, probability generating, and moment generating functions. Inversion and uniqueness theorems for characteristic functions. Chebychev's and Kolmogorov's inequalities, modes of stochastic convergence. Weak and strong laws of large numbers. Central limit theorems.

AS.161 Statistical Methods-I (3L + 1P) I

Moments and cumulants. Discrete probability distributions: Bernoulli, Uniform, binomial, Poisson, geometric, hypergeometic, Negative binomial, Multinomial etc. Continuous probability distributions: Rectangular, exponential, Cauchy, normal, gamma, beta, Weibull, lognormal, logistic etc.

Association between attributes, Correlation and regression. Partial and multiple correlation and regression, Correlation ratio. loglinear models.

AS.162 Statistical Methods-II (3L + 1P) II

Central and non-central x2, t, and F distributions. Truncated and compound distributions, Concept of characterisation of distributions. Pearsonian curves. Bivariate normal distribution-conditional and marginal distribution.

Sampling distributions-sampling from normal populations and associated sampling distributions. Sampling distribution of correlation and regression coefficients. Distribution of order statistics.

(Pre-requisite AS.160 and AS.161)

AS.163 Statistical Inference (4L + 1P) III

Point estimation, Properties of Estimators: Unbiasedness, consistency, efficiency and sufficiency, Cramer-Rao inequality, Rao-Blackwell theorem, Completeness and bounded completeness. Basu's theorem. Methods of maximum likelihood, least squares, minimum Chi-square.

Testing of hypothesis: Two kinds of errors. Neymon-Pearson Lemma. Power function. Uniformly most powerful tests, unbiased tests. Likelihood ratio tests. Robust tests and robust estimation. Tests based on t, Chi-square and F. Cochran's theorem. Nonparamatric tests-Run, Sign and Median tests. Sequential analysis: Sequential probability ratio test. Elements of Decision theory and Bayessian Inference, Categorised data analysis.

(Pre-requisite AS.160, 161 and 162)

AS.164 Design of Experiments-I (3L + 1P) III

Basic principles of design of experiments. Uniformity trials-shape and size of plots. and blocks. Elements of linear estimation, analysis of variance and covariance. Completely randomised, Randomised block and Latin square of designs.

Factorial experiments, confounding in 2^n and 3^n experiments. Split plot and strip-plot designs. Balanced incomplete block designs (general properties), analysis of BIB designs with recovery of inter-block information, construction of BIB designs.

Variance stabilizing transformations. Sampling in field experiments. Analysis of a group of experiments. Switch over designs. Experiments on cultivators fields.

AS.165 Sampling Techniques-I (3L + 1P) III

Probability sampling. Sampling distribution. Simple random sampling, estimation of proportions, confidence interval, determination of sample size, inverse sampling. Sampling with varying probabilities with replacement. Stratified sampling. Ratio and regression methods of estimation. Cluster sampling, Multi-stage sampling. Self weighting designs. Systematic sampling.

AS.165 (a) Planning and organisation of Surveys (1L + 1P) I

Formulation of data requirements, Nature of survey-ad-hoc or repetitive, (pilot or large scale), Methods of data Collection, Questionnaire versus Schedule, Survey reference and reporting periods, problem of sampling frame, choice of sampling design, Survey execution-field work, data collection, Data processing, Preparation of report, Agricultural surveys-some case studies.

AS.166 Statistical Genetics-I (3L + 1P) II

Analysis of segregation, detection and estimation of linkage for qualitative characters. Gene and genotypic frequencies, random mating and Hardy-Weinberg law for single locus with two allele, simple cases of selection, coefficients of inbreeding and relationship. Polygenic system for quantitative characters, concepts of breeding value and dominance deviations, genetic variance and its partitioning, correlations between relatives, heritability and genetic correlation-methods of their estimation in plants and animals. Truncation selection, prediction of response to individual selection, progeny row selection in plants, progeny testing and methods of sire evaluation in farm animals, full-sibs, and half-sibs selection. Combination of characters, discriminant function and selection index methods. Various systems of cross breeding, heterosis, concepts of general and specific combining abilities.

AS.167 Multivariate Analysis (2L + 1P) I

Multivariate normal distribution, marginal and conditional distribution. Estimation of mean vector and dispersion matrix. Wishart distribution and its reproductive property. Hotelling's T^2 and Mahalanobis' D^2 statistics and their distribution. Uses of T^2 and D^2 in testing problems. Wilks tests of independence of normal variates. Distribution of multiple and partial correlation coefficients.

Discriminant function-classificatory problems, principal components, canonical correlation. Factor analysis. Multivariate analysis of variance.

(Pre-requisite AS.160, 161, 162 and 163)

AS.168 Econometrics-I (2L + 1P) II

Concept of stochastic and deterministic models in representation of economic phenomena. Study of single equation linear regression models. Maximum likelihood and ordinary least squares method of estimation, Statistical inference in linear regression, estimation subject to linear restrictions, Use of dummy variables; Multicollinearity; Generalized Aitken 's least-squares method of estimation; Heteroscedasticity, Auto-correlation; Seemingly unrelated regressions; Distributed lag models, use of instrumental variables, Specification problem.

AS.169 Official Statistics (2L) II

Basic and current agricultural statistics including land use statistics. Systems of collection of agricultural statistics crop forecasts, crop estimation. Improvements effected in Indian Agricultural Statistics in recent years and scope for further improvements. Statistics of livestock and livestock products. Statistics of fisheries.

Agricultural census. Forestry statistics. Prices of agricultural commodities. Agricultural wages, Indices of agricultural production, prices, wages, etc. Cost of cultivation of crops. NSSO surveys. Statistics needed for agricultural planning. Publications in agricultural and animal husbandry statistics.

AS.170 Statistical Techniques in Bio Assay (1L + 1P) II

Direct assay investigations of dose response relationship, parallel line assay, slope ratio assay, choice of doses and efficiency in direct assay-designs suitable for bio-assay. Indirect assay based on quantal response, probit, logit and angular transformations and percentage response-Bacteriological sampling in dilution series, other methods of estimation of median effective dose.

AS.171 Statistical Quality Control and Sampling Inspection (2L) II

Shewharts control charts X, R, P, K and c-charts, modified control limits, two-way p-charts, outlier tests, single and double sampling plans. Dodge Roming tables, sequential sampling inspection plans. Sampling for variables-some cost considerations.

AS.172 Statistical Techniques in Demography and Birth and Death Process (2L) II

Birth and death stochastic process, Markoff process with finite number of states, contagious distributions, Poisson process, fertility and mortality rates, crude and standard rates, net reproduction rate, description of mortality and life tables.

AS.200 Design of Experiments-II (3L + 1P) I

Elementary constructions of BIB designs, partially balanced incomplete block designs with 2 associate classes (including square lattice designs). Youden squares, Fractional replication of symmetrical factorial. Asymmetrical factorials construction and analysis of balanced confounded designs. Response surface design. Experiments with mixtures and mixture designs.

(Pre-requisite AS.164)

AS.201 Sampling Techniques-II (3L + 1P) I

Sampling with varying probabilities, Ordered and unordered estimators. Sampling strategies due to Horvitz-Thompson, Midzuno-Sen, Rao, Hartley and Cochran and PPS systematic sampling. Integration of surveys. Lahiri's and Keyfitz's procedure. Double Sampling, sampling on two occasions. Non-sampling errors-sources and classification, imperfect frames, non-response in surveys, methods of imputation, response errors-interpenetrating sampling.

(Pre-requisite: AS.165)

AS.202 Statistical Genetics-II **(3L + 1P) I**

Amount of information about linkage, combined estimation, disturbed segregation. Disequilibrium due to linkage for two pairs of genes, sex-linked genes, forces affecting gene frequency-selection, mutation and migration, equilibrium between forces in large populations-polymorphism, genetic load, Fisher's Fundamental Theorem of Natural Selection. Path Coefficients, Regular systems of inbreeding, random drift effect of finite population size. Effect of inbreeding on quantitative characters, effects of linkage and epistasis, heritability of all-or-non traits, repeatability and its estimation, optimum group size in progeny testing and family selection, best linear unbiased prediction, combined selection-individuals, full sibs and half sibs, efficiency of selection indices. Correlated response to selection, auxiliary traits and phenotypic index. Linex tester analysis, diallel crosses-Graffings' approach, analysis of variance of diallel table. Breeding plans in plants and animals.

AS.203 Advanced Regression Analysis **(2L + 1P) II**

Multiple regression modes, qualitative variables as regressions, effect of measurement error in regressors. Generalized and weighted least squares, Problem of multi-collinearity and analysis of collinear data, Biased estimation procedures, Regression diagnostics, Mixed estimation procedures. Robust regression, Selection of variables and model building. Adequacy of models. Non-linear regression models.

AS.204 Linear Models **(3L) I**

Generalised inverse of matrices. Theorem on distribution of quadratic forms. Gaus-Markoff theorem-Method of least square-concept of estimability-criterion of estimability. Special cases of one and two-way classification (including disproportionate cell frequencies and interaction). Aitken's models. Estimation and test of hypothesis in linear models. Analysis of covariance. Variance components models, estimation of variance components. Mixed models.

AS.205 Advanced Multivariate Analysis **(3L) I**

The distribution of partial and multiple correlation coefficient. The distribution of T^2 statistics under alternative hypothesis and the power function. The multivariate Behrens-Fisher problem. Properties of Wishart distribution. Multi-variate extension of Cochran's theorem of quadratic forms, distribution of sample generalized variance, testing of general linear hypothesis, Multivariate analysis of variance, testing independence of sets of variates, testing hypothesis of equality of mean vectors and covariance matrices. Principal components. Canonical correlations and their distribution. Theory of discriminant function. Classification of observations.

(Pre-requisite: AS.167)

AS.206 Non Parametric Methods (2L + 1P) I

Order statistics. Joint distribution of order statistics. Distribution of range. Asymptotic distribution, theory of order statistics. Point estimation using order statistics. Testing for Distribution free methods for (i) the two sample problems, (ii) the k sample problems, (iii) testing for randomness (iv) testing for goodness of fit and (v) testing for independence. Large sample properties of distribution free tests. Distribution free confidence intervals for quantiles.

AS.207 Decision Theory (2L) III

General statistical decision function. Risk, regret and loss functions. Admissibility and completeness. Choice of a decision function. Baye's decision rules, their construction and properties. Minimax decision rules. Zero sum two-person games. Randomised and non-randomised decision functions. Application to standard distributions.

AS.208 Advanced Statistical Inference (2L) II

Robust estimation and robust tests. Bias reduction Jackknife statistics. Bootstrap methods. Detection and Handling of outliers in statistics data. Ranking and selection procedure. Density estimation.

AS.209 Stochastic Processes (2L) II

Stochastic processes and their classification. Spectral and correlation functions. Random sequences. Markov Chains Markov process. Stationary process. Some simple time dependent stochastic processes regarding population growth such as Poisson process, pure birth process, birth and death process etc. Branching process. Epidemic process. Diffusion process.

AS.260/Ag. Econ.110 Agricultural Econometrics-I (3L) III

Representation of economic phenomenon, relationship among economic variables, linear and non-linear economic models.

Ordinary least square method of estimation of simple and multiple regression models. The BLUE Properties of least squares estimate. Tests of significance and confidence intervals. Summary statistics-Correlation matrix, residual variance, Co-efficient of multiple correlation, standard errors of estimated co-efficients and their uses, Partial correlation and its uses. Maximum likelihood estimation.

Multi-collinearity, principal component analysis, use of dummy variables, Generalized Aitken's least-squares methods of estimation, Random co-efficients models, Stochastic regressors, Heteros-cedasticity, Auto-correlation, Durbin-Watson test, Estimation from grouped data, specification error.

Multicollinearity and possible remedies. Heteroscedasticity of disturbances, tests and possible remedies, weighted regression. Auto-correlation between disturbances and its consequences in time series analysis, Durbin-Wetson test for autocorrelated disturbances, Aitken's generalised least square method of estimation.

(Pre-requisite: Ag. Econ. 100)

AS.261 Stationary Time Series (1L) III

Stochastic approach for the analysis of statistical time-series; notion of a random variable in n-dimensions; the general random and normal processes; normal stationary process; harmonic process; periodogram analysis; correlograms; disturbed harmonies and process of moving average; tests for correlogram in autoregressive and moving average schemes; significance test of regression co-efficients based on time-series.

AS.262 Linear Programming (2L) III

Theory of convex sets; Simplex method; duality; treatment of degeneracy.

Parametric and stochastic programming, dynamic programming, integer programming; elementary ideas of non-linear programming.

Application to transportation problem and input and output.

Elements of game theory, two person-zero-sum-games, relationship between game theory and linear programming.

AS.263/Ag.Econ.111 Agricultural Econometrics-II (3L + 1P) I

Mixed estimation. Use of instrumental variables in regression analysis, Errors in variables models. Distributed lag models, alternative specifications-partial adjustment and adoptive expectation models, Grouping of observations, Grouping of equations.

Simultaneous equation systems: Basic rational identification problems, Single equation methods of estimation-indirect least squares, two stage least squares and K-class estimators, and limited information maximum likelihood, system methods of estimation (three-stage least squares and full information maximum likelihood), Relative merits of these methods and their small and large sample properties, Recursive models.

(Pre-requisite: Ag. Econ-110)

AS.299 Seminar I, II and III

AS.320 Incomplete Block Designs (3L) I

Concepts of group, fields and ring. Finite geometrics (Euclidean Geometry and Projective Geometry).

Mutually orthogonal Latin squares. Balancing in Block designs. General analysis of block designs. M-associate PBIB designs and their association schemes, classification of PBIB of signs.

(Pre-requisite: AS.200)

AS.321 Theory of Factorial Experiments **(2L) II**

Orthogonal and balanced arrays, Fractional replication, regular and irregular fractions.

Balanced fractional experiments-characterisation and analysis (symmetrical and asymmetrical factorials).

(Pre-requisite: AS.200)

AS.322 Response Surface Designs **(2L) III**

Rotable designs-symmetrical land asymmetrical blocking. Choice of response surface design-bias and variance errors. Experiments with mixtures and designs.

(Pre-requisite: AS.200)

AS.323 Design of Experiments-III **(2L) I**

Optimality criteria, robustness of designs, Augmented designs, designs for 2-way elimination of heterogeneity.

(Pre-requisite: AS.200, 320, 321 and 322).

AS.340 Advanced Sample Survey-I **(2L + 1P) II**

Number of strata and optimum stratification. Controlled selection. Two way stratification, collapsed strata. Unbiased ratio and regression type estimators, multivariate ratio and regression methods of estimation. Systematic sampling in two dimensions, Multi-stage sampling with unequal probabilities.

AS.341 Advanced Sample Survey-II **(2L) III**

PS sampling, super population concept-comparison of various sampling strategies, Variance estimation with complex designs, Taylor's series linearisation, balanced repeated replication, Jackknife and boot strap methods. Regression analysis and categorical data analysis with data from complex survey designs.

AS.342 Advanced Sample Survey-III **(2L) I**

Unified theory of sampling from finite populations. UMV- Non existence theorem and existence theorem under restricted conditions. Concept of sufficiency and likelihood in survey sampling, Admissibility and hyperadimissibility, Inference under super population models-concept of designs and model unbiasedness, prediction approach.

AS.350 Advanced Statistical Genetics-I **(3L)II**

Hardy-Weinberg law with multiple allelic systems, auto-tetraploids and self-sterility alleles. Complex cases of selection with two and more loci. Different approaches to study inbreeding process-methods of path co-efficients, Probability and generation matrix, mixed inbreeding and random mating, effect of linkage on inbreeding systems, balance between inbreeding and selection, fixation index and structured populations. Stochastic process of gene frequency change, transition matrix approach using finite Markov-Chains, diffusion approximation, steady decay and distribution of gene frequency, Probability of fixation of a gene, conditional process-Markov chains and diffusion approaches, moments of distribution of time until fixation. Random fluctuations in selection intensity. Stationary distribution of gene frequency. Effective population size.

AS.351 Advanced Statistical Genetics-II **(2L) III**

Multiple allelism in continuous variation. Sex-linked genes, maternal effects and genotype × environment interactions-estimation of their contributions, regression method for genotype × environment interactions. Effect of selection on heritability, non-normality, Inter-individual heritability, generalised heritability. Correlation between relatives in inbred populations. Selection limits and duration of response to selection. Optimum designs for progeny testing-economic considerations. Restricted selection indices, combined selection with auxiliary traits.

AS.352 Advanced Statistical Genetics-III **(2L) I**

Problem of estimation and testing in cross among inbred lines, theory and analysis of diallel crosses-Hayman's approach, partial diallel crosses (PDC) based on PBIB designs, and partial circulant structure, autmented PDCs, optimal plans for PDCs. Triallel crosses. Double crosses. Recurrent selection and reciprocal recurrent selection. Crossing and selection programme for the production of a new breed.

AS.371 Recent Developments in Sampling **(1L) II**

Recent developments in the field of sampling will be covered by various speakers from the Institute as well as from outside.

AS.372 Recent Developments in Genetical Statistics **(1L) II**

Recent developments in the field of genetical statistics will be covered by various speakers from Institute as well as from outside.

AS.373 Recent Developments in Design of Experiment **(1L) II**

Recent developments in the field of design of experiment will be covered by various speakers from the Institute as well as from outside.

Core Courses

(A) M.Sc.

(i) Within the discipline:
Agricultural Statistics
AS 160-AS 169

(ii) Outside the discipline:
Genetics
Gen 100 (A)

(B) For Ph.D.

(i) Within the discipline:
Agricultural Statistics
AS 166, AS 169, AS 203, AS 204, AS 206, AS 209

(ii) Outside the discipline
Genetics
Gen 100 (A)

VII Agronomy

Major fields : Crop Husbandry
Soil and Water Management

Minor Fields : Every Ph.D. student shall take not less than two minors (9 credits of course work) and every M.Sc. student not less than one minor in other supporting major fields from disciplines such as :

Agricultural Economics
Agricultural Engineering
Agricultural Physics
Agricultural Statistics
Biochemistry
Environmental Science
Genetics
Horticulture
Microbiology
Plant Physiology
Soil Science and Agricultural Chemistry

DESCRIPTION OF COURSES

*RC.1 Principles of Crop Production and Rabi Crops (1L + 2P)I

Important crops of India, crop plant in relation to environment; plant and plant growth; special problems in soil management; water relation of plants; moisture conservation; tillage in agriculture; seeds sowing, crop sequence and maintenance of soil fertility; multiple cropping; manures and fertilizers and their role in crop production; weeds and their control harvesting, storing and marketing of farm crops; mixed cropping; dry farming.

Practical : Agronomic practices (including production and protection techniques) for important rabi crops including wheat, barley, bengal gram, lentil, field peas, potato, mustard, toria, safflower, sunflower, sugarcane and vegetables.

*RC.2 Kharif Crops (2P)II

Agronomic practices (including production and protection techniques) for important kharif crops including rice, maize, sorghum, millets, green gram, black gram, red gram, cowpea, soybean, cotton, jute and vegetables.

Ag.101 Fodder and Pasture Crops (3L + 1P)III

Importance of fodder and pasture crops in farming systems and their role in maintaining soil fertility; classification of various fodder and pasture crops, natural grasslands of India.

Technology of fodder production for different farming system, preservation of fodder crops—techniques and principles involved, crop suitability and quality of end products.

Establishment of pastures and their management with special reference to weed control and fertilisation including micronutrients important to animals, defoliation and its effects, regeneration of infested pastures.

Ag.200 Principles of Crop Production-II (4L)III

Modern concepts pertaining to tillage and tillage operations, following vs. intensive cropping, yield potentials of crops and their relationship to fertility status of soil, methodological interpretation of fertiliser experiments, crop plants in relation to environment, space per plant in relation to competition within the crop, competition between component crop plants in a mixed crop and between crops and weeds, optimum plant population in relation to soil fertility, solar radiation and available moisture regimes, advanced treatment of principles involved in growth analysis, quantitative agrobiological principles and their validity, Mitscherlich yield equation, its interpretation and applicability, concept of inverse yield-nitrogen law, maximisation of crop yields and the apparent limitations, economics of crop production, law of diminishing returns in crop production.

Ag.201 Crop Geography and Ecology (3L)I

Scope, factors (physical and social) determining crop distribution, classification of climate, bioclimatic zones, physiological limits of crop yield and variability in relation to the ecological optimum, adaptation, humidity provinces, photo and thermoperiodism, geographic distribution of crop plant, growth and development; relationship of developmental physiology, manipulation of developmental physiology of crops.

Ag.202 Principles and Practices of Weed Control in Crops (3L + 1P)II

Scope of weed control, multiplication and dissemination of weeds, prevention of weed dissemination, principles of weed control, cultural, biological and chemical methods of weed control, weedicides and their application in field crops, weed problems in cropped and uncropped areas, special weed problems of India.

Equipment and its use in herbicidal spraying, common Indian weeds, their characteristics and identification.

Ag.203 Kharif Cereal Crops (Rice, Maize, Jowar and Bajra) (3L + 1P)III

Introduction, origin, history, production and distribution, classification, description and varietal improvement of the crops, adaptability, climate, soil, water and cultural requirements, development and nutrition of the crop plants based on agronomic investigation, quality—its components and factors affecting it, handling and processing of the produce, crop protection.

Ag.204 Commercial Crops-I (Fibre Crops and Oilseeds) (3L + 1P)II

Introduction, origin, history, production and distribution, classification, description and varietal improvement of the crops, adaptability, climate, soil, water and cultural requirements, development and nutrition of the crop plants based on agronomic investigations, quality—its components and factors affecting it, handling and processing of the produce, industrial uses, crop protection.

Ag.205 Commercial Crops-II (Sugarcane, Potato, Tobacco and Chillies) (3L + 1P)I

Introduction, origin, history, production and distribution, classification, description and varietal improvement of the crops, adaptability, climate, soil, water and cultural requirements, development and nutrition of the crop plants based on agronomic investigations, quality—its components and factors affecting it, handling and processing of produce, industrial uses, crop protection.

Ag.206 Soil Fertility and its Management (3L + 1P)I

Soil fertility problems, essentials of plant growth, soil fertility in relation to physical and chemical characteristics, plant nutrients, their availability, field management and diagnostic techniques, nutritional needs of crops, lime and sulphur application, soil organic matter and organic manures in relation to crop production, activities of soils organisms affecting crop productivity, contribution of green manures, crop rotations and soil fertility.

Development of fertiliser use in general and of nitrogenous and phosphatic fertilisers in particular, fundamentals and methods of application, new fertiliser materials and principles of their evaluation, summary of important fertiliser trials including long term experiments, use of fertilisers in multiple cropping systems, principles underlying the purchase of fertiliser, economics of fertiliser use, crop production under fertiliser constraints, fertiliser management and water availability.

Ag.207 Principles and Practices of Irrigation (3L + 1P)II

Role of water in plant development and crop production, place of irrigation in world and Indian agriculture, soil and water relations, water movement in soils, management of soil moisture stress and plant growth, quality of irrigation water, time of irrigation, quantity of water to be applied and its measurement, methods of water application, implements for irrigation farming, consumptive use of water, methods of determining irrigation requirements, irrigation requirement of important farm crops, cropping patters in relation to water supplies, irrigation in relation to other cultural practices, development of new irrigation projects in India.

Ag.208 Management of Saline, Alkali and Acidic Soils (3L + 1P)II

Introduction, nature and properties of saline, alkali and acidic soils, plant responses to soil reaction, extent of damage to crops, salt tolerance of crop plants, irrigation and drainage requirements, selection of crops and developing cropping patterns for alkali and acidic soils, use of saline water in crop production and reclamation; use of soil amendments for management and improvement of such soils; agronomic practices in relation to soil salinity, alkalinity and acidity.

Ag.210 Agronomy of Pulse Crops (3L)I

Introduction, origin, history, production trends, adaptability, classification, description, and varietal improvement; climate and soil requirements; cultural practices, fertiliser and other nutritional requirements, chemical weed control, water management, plant protection; harvesting and threshing; utilisation, including industrial by-products; place of pulse crops in multiple, relay and intercropping systems; nutritive value; role of grain legumes in building soil fertility and moisture conservation.

Ag.211 Management of Excess Soil Water and Crop Production (2L + 1P)III

Excess soil water conditions, sources and occurrences, rainfall analysis and water balance; effect of excess soil water on crop growth; agronomic practices including selection of crops for efficient crop production under excess soil water conditions; water fluctuation and side movements; lowering of water table for successful crop production; control of excess water through field drainage with special emphasis to crop production and soil salinity; interrelationship of drainage with cropping patterns and types of farming.

Ag.212 Dryland Agronomy (3L + 1P)I

Definition and delineation of dry farming areas; drought resistance in crops; mechanisms for drought tolerance and crop adaptability to drought situations, drought tolerant crops and crop varieties; plant ideotypes or dryland areas, shoot and root growth characteristics; soil moisture conservation and utilisation, moisture retention and availability concepts, infiltration and ion movement; water absorption by plant under stress conditions; controlling evaporation and transpiration losses; mulches, their kinds, effectiveness and economics; antitranspirants and light reflectants; water harvesting, concept, techniques and practices; agrotechniques, cropping patterns, fertiliser use, weed control and other management practices.

Ag.213 Rabi Cereal Crops (Wheat and Barley) (3L + 1P)I

Introduction, origin, history, production and distribution, classification, description and varietal improvement of the crops; adaptability; climate, soil, water and cultural requirements, development and nutrition of the crop plants based on agronomic investigation; quality—its components and factors affecting it; handling and processing of the produce; crop protection.

Ag.299 Seminar (1L)I/II/III

Ag.301 Fertiliser Management in Crops and Cropping System (2L + 1P)II

Fertiliser materials available in India, their production and consumption; choice of fertilizers in relation to soil-crop eco-systems; field experimental techniques for evaluating fertiliser materials; residual and cumulative effects of fertilisers in cropping systems; field experimental techniques for undertaking such studies and methods of analysis for determining such effects.

Importance of secondary and micro nutrients for optimising crop production, their importance for specific crops; symptoms of their deficiency and their remedies, Integrated nutrient management in crop production, proper utilisation of organic manures and bio-fertilisers.

(Pre-requisite : Ag.206)

Ag.302 Irrigation Management in Crops and Cropping Systems (2L + 1P)II

Water resources of the country and their development, Integrated water use. Farm water demand, factors affecting water demand, its importance in relation to crop water requirement in mono and multiple cropping systems; preparation of alternative crop plans in relation to water supply and quality.

Water movement in soil, infiltration, redistribution and capillary contribution in relation to irrigation requirement of crops, soil and land survey for soil irrigability classification, agricultural land development for irrigated agriculture, irrigation management of important crops under different soil and agroclimatic conditions.

(Pre-requisite : Ag.207)

Ag.303 Rice Agronomy (2L)I

Kinds of rice culture and their ecosystems, constraints of production in different rice cultures, nutrient transformation in submerged and upland rice soils; improving nutrient use efficiency; integrated nutrient management in rice-based cropping systems, agronomic management of problematic rice soils; integrated weed control practices in rice cultures; recent advances in water management research in rice crop.

Ag.305 Advance Technology in Pulse Production (2L)II

Cause of low yields and strategies for improving the production and productivity of pulses; significance of legumes in farming systems; pulses in non-traditional areas—new approaches, spring/summer pulses—for improving productivity nodulation—BNF, quantification of N economy in legume based on cropping intercropping systems, current transfer of N in an intercropping systems, sources of S and phosphates in pulses, use of bio-fertilizer for enhancing the production of pulses, micro-nutrient in pulses, pulses in rainfed/dryland areas; yield stability in pulses, flower drop and growth regulators in pulses.

Ag.306 Cropping System **(3L)I**

Definition, scope and history, classification, principles and practices of sequential/rotation, relay and mixed/intercropping systems, rice, sorghum, pearl-millet and millet based systems, selection of crops and their cultivars, cereals, legumes, and oilseeds; cultural operations, minimum/zero tillage, water management in cropping systems, weed association and their control, direct, residual and cumulative effect of applied fertilisers, use efficiency, use of organic manures; recycling of organic residues, maintenance of soil health, pest interception/ allelopathy, cropping plans and strategies, efficient crop zones, crop substitution/diversification, necessity and role of mechanization, use of turn around period, energetics and econometrics.

Core Courses

Core courses both for M.Sc. and Ph.D.

Ag. 200, 202, 206, 207 and AS. 121.

VIII Biochemistry

Major fields : Biochemistry
Nutrition

Minor fields : A student majoring in one of the above fields may elect to take a minor in another of these fields which are recognised as major for the discipline. But every student shall take not less than one minor (9 credits of course work) in another supporting major field from discipline such as :

- Agricultural Physics
- Agricultural Statistics
- Agronomy
- Entomology
- Environmental Science
- Genetics
- Horticulture
- Microbiology
- Mycology and Plant Pathology
- Plant Physiology
- Soil Science and Agricultural Chemistry
- Molecular Biology and Biotechnology

DESCRIPTION OF COURSES

Bio.100/SSAC.105 Biochemistry-I **(3L + 1P)I**

Scope and importance of biochemistry in agricultural sciences; Buffers chemistry of amino acids and proteins; enzymes; chemistry of carbohydrates, carbohydrate metabolism and energy production; fats; vitamins and coenzymes; hormones; nucleic acids and synthesis of proteins.

Bio.101 Nutrition **(3L + 1P)I**

Fundamental principles of nutrition; balanced diet; calorie requirement; nutritive value of food; essential amino acids; biological values and digestibility of proteins; feeding experiments with animals; vitamins, minerals and their chemical and microbiological assay; digestive enzymes; biochemical basis of nutritional disorders.

Bio.102 Cereal Chemistry **(2L + 1P)II**

Structure and composition of cereal grains; chemistry of cereals and cereal products; quality of food grains as affected by different factors; cereal proteins and limiting amino acids; enrichment of cereal products; lipids and phenolic compounds in grain.

Bio.103 Techniques in Biochemistry **(2L + 1P)III**

Assay of enzymes; manometric and Thunberg techniques; use of spectrophotometer in biochemical reactions; counter-current distribution chromatography; gel electrophoresis; gel filtration; ultracentrifugations; dialysis; preparation and purification of cell particulates; density gradient centrifugation; use of isotopes in biochemical studies; fluorimetry; automated amino acid and nitrogen analysis.

Bio.200 Biochemistry-II **(3L)II**

Intermediary metabolism of carbohydrates and its control; Bioenergetics and oxidative phosphorylation; pathways of the synthesis of amino acids, purines, pyrimidines and their degradation; protein metabolism.

Bio.201 Biochemistry-III **(3L)III**

Biochemistry of photosynthesis in higher plants and bacteria; comparative biochemistry of different electron transport systems; biochemistry of ion transport; transformation of sulphur and its compounds; fat metabolism.

Bio.202 Inorganic Nitrogen Metabolism **(3L + 1P)II**

Biochemistry of nitrogen cycle in nature; enzymes involved in biological nitrogen fixation and the sources of reducing power; biochemistry of ferredoxin and other non haem iron proteins; biochemical basis of symbiosis; carbon assimilation in chemoautotrophs and the enzymes involved in the oxidation of ammonia to nitrate; phosphorylation involved in denitrification, biochemistry of nitrate assimilation, *ntr* and *nif* genes, role of uptake hydrogenase in N_2^- fixation.

Bio.203/MBB.212 Enzymology **(3L + 1P)III**

Protein structure conformation; Enzymes, classification, assay, isolation and characterisation, specificity, mechanism of action, transient and steady state 1 kinetics; active site mapping, regulation of enzyme activity; multi-enzyme complexes, enzymes and their action.

Bio.206 Biochemistry of Plant Diseases (3L)II

Discovery of viruses; isolation and purification of viruses; preparation and characterisation of viral components; proteins and nucleic acids of viruses; chemical and physical properties of viruses and nature of infectivity; reconstitution of viruses; virus-host cell relationship; biochemical basis of resistance to plant diseases.

Bio.208/Gen.232/MBB.211 Nucleic Acids (2L + 1P)I

Biosynthesis of nitrogenous bases and nucleotides; Chemistry of nucleic acids; Structure and conformation of DNA and RNAs; DNA topoisomers, tRNA, mRNA and rRNA;Nucleases, endonucleases and related-enzymes; DNA sequencing; Chemical synthesis of nucleotides and nucleic acids.

Bio.209/MBB.200/Gen.233 Protein Synthesis (3L + 1P)II

Genetic code; structure and function of mRNA and tRNA, Ribosome structure and functions; Organisation and regulation of ribosomal protein and RNA genes; Ribosome-mRNA interactions, Colinearity in protein biosynthesis in pro-karyotes and eu-karyotes, amino acid activation, polypeptide chain initiation, elongation and termination; Post-translational modifications and their significance.

Bio.210/Gen.234/MBB.201 Gene-Regulation (3L)III

General control of DNA, RNA and protein synthesis; Gene regulation in pro-karyotes; Gene clustering and operon concept, Mechanism of positive and negative control of gene expression; Translational and transcriptional control of regulatory mechanism of gene expression in eukaryotes; Role of post-transcriptional and post-translational events in gene regulation; Isolation of repressor and characterization of operator.

Bio.211/MBB.203 Genetic Engineering (3L + 2P)I

DNA cloning strategies; cloning in yeast, *Escharichiacoli* and *Bacillus subtilis*, Characteristics of vectors derived from bacterial plasmids and phages and plant and animal viruses; Methods of nucleic acid and protein separation and sequencing; Restriction enzymes, Preparation and screening of genomic and cDNA libraries; Identification and isolation of structural genes and regulatory elements; Site directed mutagenesis; Transfer of cloned DNA and expression of cloned genes in foreign cells. Antisense RNA, Ribozymes and PCR.

Bio.299 Seminar (1)

Bio.300 Advance Course in Nutritional Biochemistry (3L)II

Role of micronutrients in newly developed varieties of food crops in the biocemical systems, Carbohydrate, protein and lipid metabolism in human body, biosynthesis and metabolism of lipids and fatty acid, lipoprotein and Cholesterol metabolism, Inter-relation of carbohydrate, protein and fat metabolism under different nutritional status, Hormones from endocrine gland and their function, Thyroid, Pancreas, Adrenals, Pituary and sex hormones, the bolld and its function, composition of blood, cloating of blood, Pasaprotein, anaemias.

Bio.301 Food Nutrition and Diet Therapy (4L + 1P)III

Digestion, absorption and metabolism of food(s); Nutrition in infancy, childhood, Adolescence, adulthood, Pregnancy, lactating and aged; Diet Therapy and Nutritional care in diseases (like Gastric disease, intestinal disease, Diseases of liver endocrine, Pancrease, diseases of Thyroid or parathyroid gland, weight management, cardiovascular disease, diseases of Kidney, allergy, metabolic stress, Cancer, Children with metabolic disorder and recommended diet; use of drugs and their interactions.

Bio.302 Food Technology (3L + 1P)II

Introduction of body need of Oxygen, water and foods; Role of environmental factors in food preparations; Processing of Food (Parboiling, milling, malting and fermentation); Processing of milk and milk products (Thermal treatment, precipitation and storage effect); Metal contamination in processed foods, dehydration of vegetable, fish and meat; Effect of storage, Cooling, preservation and canning; Fruit and vegetables as a source of mineral and vitamins; Fats in nutrition; preparation and palatability; and effects of processing on the nutritional quality.

Bio.305 Lipid Biochemistry (2L + 1P)II

Structure of phospholipids and triacylglycerols and Acyl group distribution theories, Cyclopropenoid, Oxirane ring containing other unusual fatty acids, Fatty acid isomerism, Biosynthesis and degradation of individual fatty acids, triacylglycerol and phospholipids, Structure and function and acyl lipids, Biosynthesis of acylated steryl and steryl glycosides and their role in protein biosynthesis, Lipoproteins and phospholipid exchange systems, Structure and function of membrane lipids, Positional and fatty acid specificity and immobilization of lipolytic enzymes, lipoxidase, B-Oxidation, Structure and function of prostaglandins, Fatty acid synthetase and lipid synthesis in lower plants by molecular cloning, Hydrogenation, interesterification and glycerolysis and their implications in food processing, Toxic factors associated with plant lipids, Rancidity, autoxidation and mechanism of action of antioxidants.

N.B. Bio.301, Bio.302 and Bio.305 courses will be offered in alternative years.

Core Courses

Core courses both for M.Sc. and Ph.D. :

(i) Within discipline : Bio.100, 101 and 103

(ii) Outside the discipline : Bio.100.

IX. Computer Application

61
12
74

Major field : Computer Application

Minor Fields : A student majoring in the above filed shall normally take at least 20 per cent of the course work in one minor field in the supporting major field from the disciplines such as :

Agricultural Economics
Agricultural Engineering
Agricultural Extension
Agricultural Physics
Agronomy
Entomology
Environmental Science
Genetics
Horticulture
Soil Science & Agricultural Chemistry

12

11
1
2

DESCRIPTION OF COURSES

CS.111 Introduction to Computer Organisation (2L)I

Input/Output units, Memory (Access, Location, Address, Content, Writing, Reading) Arithmetic and logic units, control unit (Machine Instruction, Instruction Counter)—Machine cycle (fetch and execute)—Internal representation of data (Binary system, bits and bytes, octal and Hexadecimal systems).

CS.112 Programming Languages—Basic and Fortran-77 (2L + 1P)I,II

Data Types, Assignment, Control, Input/Output Statements, Sub-program and Programme structuring statements.

CS.113 Statistical Methodology (2L + 1P)I

Summarisation of data, frequency distribution, measures of location and dispersion, moments and cumulants, Probability, Classical and frequency definitions, Conditional probabilities. Laws of probabilities, Bayes theorem, Random variable and distribution function. Discrete distributions—Binomial, Poisson, Geometric, Negative-bionomial, Multinomial, Continuous distributions—Rectangular, exponential, Cauchy, normal, Gamma, Beta, Weibull, Bivariate normal, Tests of significance—normal, Chi-square, t, F, Markov chains and stochastic processes, Curve fitting—least square method. Methods of point estimation, Interval estimation.

CS.114 Applicable Mathematics-I (2L)I

Sets, elementary logic, Boolean Algebraic Functions, Algebraic structures, trees and their properties, graphs and properties, counting techniques, generating functions, recurrence relations and solutions, groups and application of group theory to computer arithmetic, lattices and their applications in computer science.

CS.121 Computer Architecture (2L)II

Large frame computers, mini computers, microprocessor based systems and personal computers, Elementary logic gates,combinational switching circuits, flip-flops, sequential circuits, binary arithmetic operations, high speed arithmetic, random access memory (RAM), read only memory (ROM), Auxiliary Memory, Machine and assembly language programming.

(Pre-requisite : CS.111)

CS.122 Programming Language—Cobol (1L + 1P)II

COBOL Language elements, IDENTIFICATION division. Environment division, Data division—File Section—file description, record description, level-number, picture. Working—storage section—initial values, condition-names, Procedure division—I/O statements—CLOSE, OPEN, READ, WRITE Arithmetic statements—Add, Compute, Divide, Multiply, Subtract. Specific verbs—Alter, Examine, GO, IF, move, occurs, perform, stop. Declaratives. COBOL debugging techniques, COBOL compiler control.

(Pre-requisite : CS.111 or CS.112/AS.129)

CS.123 Programming Language—C (2L + 1P)III

Data types, operators, Expressions, Control flow, functions, External Variables, Scope rules, Static and resister variables, block structures, recursion, pointers, address arithmetic, array structures, table look up, files unions, Input and output, Common C-Library functions.

(Pre-requisite : CS.111 or CS.112/AS.129)

CS.124 Design of Loaders and Linkage Editors and Assemblers (2L)II

Absolute, binary symbolic system, dynamic and direct linking loaders, core image builders, overlay structure and dynamic loading, One pass and two pass assemblers, symbol table organisation, Macro assemblers.

(Pre-requisite : CS.111 or CS.112/AS.129)

CS.125 System Analysis (2L)II

System Analysis, objectives and its relation to organisation, Effective communication in system analysis, Tools of Analysis, problem definition and classification, Data collection and analysis, System planning, feasibility and final plan selection. System cost-benefit criterion and its determination, System design, testing, refining and optimising, programme specification and recognition of resource requirements.

CS.131 Computer Centre Management (2L)III

Computer Centre organisation, different constituents, maintenance, airconditioning, operation, software maintenance, programming aids to internal and outside users, computer hardware and software procurement and enhancement. Software library.

CS.132 Data Structures and Structured Programming through Pascal (2L + 1P)II

Representation of character-strings and their manipulation, linear list structures, stacks, queues, deques, Representation and processing of linearly linked lists, multiple linked structures, Tree structures, representation of tree structures and different tree traversal algorithms, sorting and searching algorithms. Structured programming through PASCAL.

CS.133 Applicable Mathematics-II (2L + 1P)III

Basic concepts of floating point number system. Implications of finite precision, rounding off errors, Interpolation, Polynomial interpolation, inverse interpolation, spline interpolation, Numerical integration—Trapezoidal, Simpson's 1/3rd and 3/8th rules, Euler-Maclaurin summation formula. Solution of ordinary differential equations; Runge-Kutta methods, Predictor-corrector methods.

CS.134 Simulation (2L)III

Simulation languages; GPSS, SIMULA, CSMP. Introduction to simulation techniques, discrete simulation models, simulation methodology, Generation, testing and use of random numbers, simulation of stochastic events and processes, random phenomena in simulation, Design of simulation experiments for optimisation, Analysis of Data generated by simulation experiments and validation of simulation models and results, Monte-Carlo Methods with applications.

(Pre-requisite : CS.112/AS.129) and (CS.113 or AS.121 or AS.161)

CS.211 Fundamental of Compiler Construction (2L)I

Compilers and translators, formal language, structure of a compiler, Lexical analysis, Symbol tables, Bottom up and Top down parsing, Semantic analysis, intermediate code generation, Optimization, code generation.

CS.212 Fundamentals of Operating Systems (2L)I

Overview of operating systems, Memory management, Processor Management, Job scheduling, Process scheduling, Device management, CP/M and UNIX operating systems.

CS.213 Introduction to Data Base Management Systems (2L)I

Definition and feature, Evolution of data base systems, Requirements of DBMS, An architecture for Data Base systems, storage media and storage structures, Data modelling and data sub-languages.

(Pre-requisite : ((CS.111) and (CS.112 or CS.129 or CS.123 or CS.132))

CS.214 Applicable Mathematics-III (2L + 1P)I 3

Solution of linear system of equations, Gaussian elimination, operation counts, implementation including pivoting and scaling, Direct factorisation methods. Solution of non-linear equations : Bisection, Newton-Raphson, false position, secant methods. Iterative methods. Computation of eigen values and eigen vectors, Basic theorems, error estimates, the power method—Jacobi's method—House holders method.

CS.221 Operations Research (2L + 1P)II 3

Optimization Methods, Programming methods—linear, quadratic, integer, dynamic, Simplex methods. Game Theory, Queueing theory Resources constrained scheduling methods, Network theory, inventory problems.

(Pre-requisite : CS.112 or CS.123 or CS.132)

CS.222 Applicable Agricultural Statistics-I (2L + 1P)II 3

Correlation and Regression—simple and multiple (linear), time series, model building and forecasting, trend and seasonability, exponential smoothing.

Multivariate-step-wise regression (up and down), ridge, regression, factor analysis, principle component analysis and canonical correlations, distance function and discriminant analysis, clustering techniques, path analysis.

CS.223 Applicable Agricultural Statistics-II (2L + 1P)II 3

Concepts of population and sample, surveys, parameter and statistics, estimation, bias, standard errors, use of computer in processing of large scale survey data—Analysis of variance, linear models, estimation of components of variance, principles of randomisation, replication and error control, completely randomised/randomised block and latin square design, Concepts of main effects and interaction in factorial experiments, optimal designs, algorithms.

CS.224 Compiler Construction (2L + 1P)II

Language for compiler development, Properties of context free grammers, Transformational grammers, Right Linear grammer, implementing Finite state machines, Push down machines, syntax directed translation, Top down parsing LL (K)-Grammer, Bottom up parsing, Error handling, LR grammers and their properties, Error Handling in LR (K) Languages, Intermediate languages, Code optimization, machine code generation, Machine dependent optimization.

(Pre-requisite : CS.211)

CS.225 Operating System (2L + 1P)II

Languages for operating system development, Process sychronisation, Concurrent processes, problem of mutual exclusion, deadlock-detection and prevention, Race conditions, semaphore classes, Monitors, semaphores for preventive race situation, Operating and counting semaphores, Processor allocation, Memory management, multi-programming with fixed and variable number of tasks, continuous allocation, Paging, demand paging, page fault, virtual memory, fragmentation, Segmented memory management, shared segments, segmented and demand paged management. Overlays and swapping. Thrashing, Processor management, different techniques of job scheduling, tasks scheduling, round Robin policy etc. Multiprocessor system, Master's slave scheduling, homogeneous scheduling. Device management system, dedicated, share and virtual devices, spooling channels, multiplexer and selector, control units, traffic controllers and device handlers, information management memory techniques, input-output file protection, design and implementation of operating system. Distributed operating system.

(Pre-requisite : CS.212)

CS.226 Management Information System (2L + 1P)II

Financial and cost accounting systems, Exponential smoothing, and discounted cash flow techniques. Port folio analysis. Inventory control, static and deterministic models, Single periods, Multiperiod under continuous and periodic review, Project scheduling, CPM and PERT Project control.

Planning Design and Implementation, Decision making with MIS, Objectives of MIS Planning, Planning techniques, MIS design concepts, implementation of MIS, System design techniques. System concepts for MIS, Problem solving and decision making, Data Information and communication of MIS, management science and system modelling.

(Pre-requisite : CS.125 or CS.213)

6 – optional

CS.227 Data Base Management System **(2L + 1P)II**

Relational Data Bases, Introduction, Normal forms, projection, join and division, operations on Relation, Data sub-languages based on relational calculus and relational Algebra, ALPHA by Code, SEQUEL, and SQUARE languages, Hierarchical data bases-information management systems (IMS), Data Base description, data sub-model, DL languages, storage structure, Logical data base, Task Group Report, Set, constructs, schema and sub-schema, Description of data sub-languages, DDL, and DML, of DBTG, Data base organisation and structure, implementation issues and Query languages, methods to Gain reliability, security, privacy, protection, integrity and validation, Algebraic filing techniques, Use of DMS II Packages.

(Pre-requisite : CS.213)

CS.299 Seminar **(1L)II**

Core Courses

CS.111 to CS.221.

Optional Courses

(1) Statistical Software : CS.222 and CS.223

(2) System Software : CS.224 and CS.225

(3) Information Systems Software : CS.226 and CS.227

49

	6	
Remedial	14	
Core	43	optional 6
Seminar	2	
AIS	1	
Gen	11	
	74	

51

X Entomology

Major Fields : Insect Taxonomy and Acarology
Inset Pest Management (Ecology and Parasitology)
Insect Toxicology
Insect Physiology-Host Plant Relationship

Minor Fields : A student majoring in one of the above fields may elect to take a minor in another of these fields. But every student shall take not less than one minor (9 credits of course work) in another supporting major field from among the teaching disciplines.

DESCRIPTION OF COURSES

***RC.3 Basic Plant Protection (3L)II**

Identification of pests and diseases; control measures of some maladies and diseases caused by insects, nematodes and pathogens; appliances and insecticides, fungicides and nematicides.

Ent.100 Introductory Course in Entomology and Economic Zoology (2L + 1P)I

History of Entomology, Entomology as basic and applied, science for prosperity, etymology, origin of insects; place of Entomology in human knowledge, its relationship with human welfare, development of the science of Entomology in India and its present status; Phylum Arthropoda and the arthropod classes, comparative position in animal kingdom, dominance of insects as a class, structural perfections; developmental characteristics, size, distribution in time and space; methods of collection, killing, fixing, setting and preservation of insects; habit, habitats, and host relationship; distinguishing characters and economic importance of non insect pests.

Ent.101 Insect Morphology **(2L + 2P)I**

Body wall structure, culticular outgrowths/colourations, special integumentary structures and modifications, sense organs etc. Body regions—sclerites and segmentation; head, thorax and abdomen—structure appendages and modifications.

Ent.102 Insect Anatomy and Embryology **(2L + 2P)II**

Insect Anatomy, comparative study of organisation, structure and modifications of (i) digestive (ii) respiratory (iii) circulatory (iv) excretory (v) nervous (vi) reproductive systems (vii) endocrine glands (viii) musculature (ix) sense organs (x) light and sound producing organs etc., embryology and development, structure of egg, embryonic and post-embryonic development, including types of metamorphosis, post-metamorphic changes etc.; historical techniques.

Ent.103 Insect Taxonomy-I **(2L + 1P)III**

Introduction to class Insecta and its position in phylum Arthropoda; history of classification of insects including evolution; methods of collecting and preserving insects; classification of insects up to orders with habit, habitat and economic importance; common terms used in taxonomic nomenclature.

Ent.104 Insect Ecology-I **(2L + 1P)I**

History of ecology, basic concepts; differences between habitats; food chain and succession; limiting factors and concepts of indicators; natural balance, interaction between biotic potential and environmental resistance; factors affecting insectal distribution in space and time; biotic and climatic control.

Ent.105 Insect Toxicology-I **(2L + 1P)I**

History of insecticides; principles of chemical control; biological and physical properties of insecticides; classification of insecticides; principles of formulation, shelf life; ISI standards; limitations of insecticidal control, phytotoxicity; bioassay techniques, laboratory evaluations; fumigants, rodenticides, molluscicides, avicides, attractants, repellents, antifeedants, chemosterilants, juvenile hormones.

Ent.106 Insect Parasitology-I **(2L + 1P)I**

The philosophy, scope, history and importance of biological control; the theoretical and empirical basis of biological control, parasitism and predatism; parasitic and predatory groups of insects; phases of parasitism, multiparasitism, superparasitism, hyperparasitism; ecological basis of biological control; methods of colonization, recovery and evaluation; introduction, culture; establishment and management of natural enemy population; biological control of weeds; some major successes in the biological control of pests and weeds; importance of natural enemies in integrated control.

Ent.107 Insect Physiology-I (1L + 2P)II

Physiology—importance and scope; various systems in insects (digestive, circulatory, respiratory, excretory, nervous and reproductive); physiology of digestion, absorption and metabolism of carbohydrates, lipids and nitrogenous compounds.

Ent.108 Economic Entomology (2L + 1P)I

Nomenclature, biology and distribution of pests of maize, cotton, sorghum and small millets, rice, sugarcane, moong, urd and cowpea, arhar, soybean, pea, lentil, and gram estimation of losses and control.

Ent.109 Economic Entomology

Nomenclature, biology and distribution of pests of rabi crops—wheat, barley, oats, mustard, rye, castor, sunflower, groundnut; tobacco and tubercrops (potato, sweat potato, tapioca jute and mesta); estimation of losses; and control.

Ent.110 Horticultural Entomology (2L + 1P)II

Pests of sub-tropical and temperate fruits, pests of vegetables; pests of spices and condiments, pests of ornamental plants, plantation crops.

Ent.111 Stored Product Entomology (2L + 1P)I

Storage and food losses in different countries; causes of losses in storage; biology of insects of cereal grains, spices and dry fruits; mites associated with stored products and their biology; rodents as pests of storage, their biology and control; detection and identification of infestation and estimation of losses etc; storage structures; prophylatic treatment; use of chemicals and fumigant to protect grain in storage; principles of grain storage.

Ent.112 Plant Protection, Quarantine and Pesticide Regulation (2L + 2P)III

Introduction to Entomology, causes for their being successful animals; principles of plant protection, insecticidal formulation, hazards, limitations, precautions in pesticide usage, antidotes treatment; plant protection organisation in the country; important exotic insect pests, quarantine laws; insecticides act; locust control, rodent, birds and non-insect pest control; plant protection appliances; biology and bionomics of major pests of crops, vegetables, stored grain and fruits.

Ent.113 Insect Vectors of Plant Diseases (1L)I

Biological relationship between plant pathogens, plants and vectors (habits of vectors, morphology, methods of feeding and inoculation, toxigenic insects and phytotoxemia), virus vector relationship; transmission of fungi, bacteria, mycoplasma through vectors, generalised/specialised transmission, active and passive transmission; control of vectors, techniques involved.

Ent.114 Entomological Techniques (1L + 1P)III

Collection, preservation, fixing, pinning and setting of insects, preparation of temporary and permanent mounts, elements of optics and use of various types of microscopes, preparation for electron microscopy/scanning microscope; use of camera lucida, photography and microphotography, mass rearing of test cultures, microtomy and histological techniques, techniques in chromotography, methods of collecting scientific literature, methods for writing scientific articles.

Ent.115 Use of Radio-isotopes and Radiation in Entomological Research (1L + 1P)II

Background for the use of radio-isotopes and radiations in entomological research, non-genetic effects and radiation; insect control by irradiation, sterile male technique—tagging and trace methodology; use of radioisotopes in insect biochemistry, physiology and toxicology.

(Pre-requisite : SSAC.105)

Ent.116 Industrial Entomology (2L + 1P)II

World history of bee keeping, races of bees in the world, their relative value; biology of bee, parasites and predators, seasonal management of bees, ecology and behaviour of bees, pheromones, methods of communication, reproduction; bees as pollinators, relationships of bees with flowering plants, honey extraction, scope as industry in India; history of lac culture, bionomics of lac insects, natural enemies, management of lac culture, production and marketing of lac; history of sericulture, ecology and physiology of silk worm, their culture and technique of rearing.

Ent.117 Insect Biochemistry (2L + 1P)III

Biochemistry of cuticle-metamorphosis, role of hormones in regulating this process; electrophysiology of nerve transmission and muscle excitation; intermediary metabolism of carbohydrates, proteins and fats with special reference to insects; biochemistry of insect development, biochemistry of insecticidal action, metabolism of insecticides in insect body, effect of insecticides in physiological systems, energy metabolism, biochemical differences between insects and higher animals.

Ent.118 Insect Resistance in Crop Plants (2L + 1P)II

History and importance of insect resistance in crop plants, mechanisms of plant resistance to insects, preference, antibiosis and tolerance; host specificity; factors that affect the expression or permanence of resistance, role of secondary plant substances in host selection/as attractants/as repellants, role of nutrients in host selection, mechanism of host selection by insects and oviposition, various concepts, host specific colour behaviour, chemoreception, phagostimulants; peculiarities of the plant reaction to pest injury; methods of investigating pest resistance in phytophagous insects; resistance to insects in major crops e.g., sugarcane, cotton, wheat, sorghum, maize, paddy and potato, breeding crops for resistance to insects; plant morphological characters contributing to resistance to insects and sampling methods.

Ent.119 Introductory Acarology (1L + 1P)I

Systematic position of Acarina; importance, collection, preparation and mounting general morphology, habits and habitats, classification of major families of economic importance; nature of damage and losses etc., ecology of mites, resistance to mites in crop plants and methods for evaluating mite population.

Ent.120 Insect Pathology (2L + 1P)III

Introduction, history, definitions, bacterial pathogens, fungi, protozoa, rickettsiae, viruses, nematodes, factors affecting the epizootiology of insect diseases, techniques in insect pathology, mass rearing, testing of insect pathogens by bioassay, field evaluation, mammalian toxicity, safety of insect pathogens, mass production and formulation, use of diseases in pest management.

Ent.200 Insect Taxonomy-II (1L + 2P)II

Classification of Insects upto families (economically important families to be dealt) and upto genera of some important groups; principles of identification keys.

(Pre-requisite : Ent.103)

Ent.201 Taxonomy of Immature Insects (1L + 1P)III

Collection and preservation of immature forms of insects; morphology, classification and recognition of immature forms (primary emphasis on economic groups); identifying immature stages and making field keys; rearing of some important species, studying behaviour of important species.

Ent.202 Insect Taxonomy-III (2L + 1P)III

Taxonomic collection and process of identification; taxonomic characters; use of statistics in insect taxonomy, numerical taxonomy, taxonomic publications; principles and application of zoological nomenclature; fossil insects; phylogeny of insects, species concept and speciation.

Ent.203 Insect Ecology-II (2L + 1P)II

Effect of constant and variable temperature, humidity; rainfall, light, pressure, sound and air currents, electrical fields, food, number of generations, biometer, water-loss, bioclimatic, dispause, hibernation, aestivation, forecast of insect outbreaks, insect migration, social life in insects, population study and estimation of losses, inter and intra specific competition, concept of population dynamics, distribution, sampling and concept of forecasting.

(Pre-requisite : Ent.104)

Ent.204 Insect Toxicology-II (2L + 1P)II

Factors affecting toxicity of insecticides; mode of action, detoxication, degradation, metabolism, synergism, antagonism, potentiation, compatibility; residues and their bioassay;

resistance, tolerance; role of insecticides in pest management; environmental pollution due to pesticides.

Ent.205 Insect Parasitology-II (2L + 1P)II

Nature and scope of biological control; biology and host relationship of parasitoids, biology and impact of predators; types of larvae endoparasites, physiology of respiration among endoparasites; immature stages of parasites and their identification; foreign exploration and importation of natural enemies, adaptability of introduced natural enemies and the factors limiting their success; models and life tables in assessing the role of natural enemies; experimental techniques for the evaluation of the effectiveness of natural enemies; selective pesticides and selective use of pesticides in integrated control, systems analysis and pest management, management of pest population by manipulating densities of both hosts and parasites through periodic releases; biological control of important pests with parasites, predators in India on major crops (sugarcane, cotton, rice and coconut), biological control of insect pests and weeds by imported parasites and predators.

(Pre-requisite : Ent.106)

Ent.206 Insect Physiology-II (2L + 2P)III

Physiology of systems including integument, endocrine glands; neurosecretions and their role in reproduction, hormones in insects and metamorphosis; nerve impulse transmission; properties of haemolymph, physiology, composition; physiology of sense organs and their mode of functioning; growth, reproduction and special modes of reproduction; light production and photoperiodism, chemoreception; intermediary metabolism of pigments, excretion and salt balance; physiology of migration; insecticides; resistance and biochemical basis for resistance; physiology of muscles; histology of major systems; chemical communication in insects; effects of insecticides on various physiological processes, mode of action and metabolism of insecticides.

Ent.207 Insect Physiology-III (1L + 2P)III

Importance of insect nutrition; nutrition of phytophagous insects, stored grain insects, other beneficial (entomophagous) insects, role of vitamins, proteins, amino acids, carbohydrates, lipids and minerals and other food constituents in insect nutrition; known and unknown growth factors; extra and intra cellular micro-organisms and their transmission, location and physiology.

Ent.208 Insect Ecology-III (2L + 1P)III

Population dynamics with emphasis on inter and intra specific competition; food chain, web, succession, floral and faunal diversity and niche relationships etc.; population dispersal and sampling, population models, key factors analysis, time series analysis; growth forms, life tables and their interpretation.

(Pre-requisite : AS.120 or 121)

Ent.209 Pest Management (2L + 1P)III

The concept and history of pest management; ecological and socio-economics aspects; tactics of plant resistance; parasitoids, predators, diseases; use of insecticides, attractants, repellents; sampling and measuring for economic levels of damage, analysis and modelling for pest management; pest management in major crops like sugarcane, cotton, rice, sorghum and maize; decision making in pest control and cropping systems; ecosystem, agrosystem, succession and incidence of crops pests as influenced by biotic and abiotic factors, life table studies; pest management in future.

Ent.210/Bio.205 Biochemistry of Insecticides (2L)II

Basic physiology an biochemistry of nervous system; mechanism of action of insecticides, action of insecticides on enzymes; biochemical basis of resistance to insecticides.

Ent.211 Seed Entomology (1L + 1P)III

Seed losses in storage; insects associated with seeds of cereals and pulses, germ eating insects, insects of vegetable seeds, different aspects of seed treatment; packaging and storage of seeds, methods of storage of seeds in coastal and north-eastern zones; different aspects of seed fumigation; preservation of seeds on long term basis; seeds and seed health law; compatibility of fungicides/insecticides used in different seed treatments; causes for losses in germination of seeds damaged by insects; role of insect pollinators in seed production, quarantine laws.

(Pre-requisite : Ent. 111)

Ent.299 Seminar (1L)

Core Courses

(A) For M.Sc.

Ent.100 Introductory course in Entomology and Economic Zoology	(2L + 1P)
Ent.101 Insect Morphology	(2L + 2P)
Ent.102 Insect Anatomy and Embryology	(2L + 2P)
Ent.104 Insect Taxonomy-I	(2L + 1P)
Ent.103 Insect Ecology-I	(2L + 1P)
Ent.105 Insect Toxicology-I	(2L + 1P)
Ent.106 Insect Parasitology-I	(2L + 1P)
Ent.107 Insect Physiology-I	(1L + 2P)
Ent.112 Plant Protection, Quarantine and Pesticide Regulation	(2L + 2P)
AS.120 Elementary Statistical Methods-I	(1L + 1P)
or	
AS.121 Elementary Statistical Methods-II	(3L + 2P)

(B) For Ph.D.

Ent.112 Plant Protection, Quarantine and Pesticide Regulation	(2L + 2P)
Ent.209 Pest Management	(2L + 1P)
AS.120 Elementary Statistical Methods-I	(1L + 1P)
or	
AS.121 Elementary Statistical Methods-II	(3L + 2P)

XI Environmental Sciences

Major Field : Environmental Sciences

Minor Field : In addition to the major field, every M.Sc. student shall take one minor field with at least 9 credits of course work from the following disciplines:

Agronomy
Plant Physiology
Soil Science and Agricultural Chemistry
Entomology
Agricultural chemicals
Mycology and Plant Pathology
Agricultural Physics
Microbiology

DESCRIPTION OF COURSES

ES.100 Introduction to Environmental Sciences (3L) I

Definitions and concepts in environmental sciences; components of environment-atmosphere, hydrosphere, pedosphere, biosphere and their interactions; energy flow in ecosystems; ecosystems of the world; biogeographic regions; biological building blocks; nutrients and nutrient cycling in different ecosystems; climate and its impact on agriculture; agroclimatic regions, soils and cropping patterns of India and agricultural productivity, biotic and abiotic interaction, plant diseases and pests; soil-plant-water-atmospheric interactions; agriculture and environmental pollution; greenhouse gases and global climatic changes; environmental issues and environmental impact analysis.

ES.101 Elements of Ecology (3L) I

History and scope of ecology, view point of modern ecology, basic elements of ecology—

the medium, the substratum, water, temperature, light, oxygen and carbon dioxide and nutrients; energy environment, concept of primary and secondary productivity, concept of ecosystem, ecological balance, ecosystem relationships within the species, relation between species, food chains, food web, trophic structure and ecological pyramids; nutrient cycling at ecosystem level, biogeochemical cycles at the biosphere levels, cycling of non-essential elements, cycling of organic nutrients, evolution of biochemical cycles; ecology of population, community concept, ecological succession and fluctuation, population dynamics, dynamics of ecosystem.

ES.102 Chemistry for Environmental Sciences (3L + 1P) III

Introduction and scope, modern atomic structure, chemical bonding, radioactivity, modern periodic table, chemistry of hydrogen, oxygen, carbon, nitrogen, halogens, phosphorous and their compounds, heavy metals, basic organic chemistry, nomenclature, reactive intermediates, chemistry of fossil fuels, fluorocarbons, basic photochemistry, acid base theory, pH, thermo chemistry, kinetic theory of gases, chemical and ionic equilibria, chemical kinetics and solutions. Analytical techniques for detecting major environmental pollutants: Classification and nature of environmental pollutants.

ES.103/SSAC.100 Fundamentals of Soil Science (3L + 1P) I

Soils-their origin, morphology and nature; classification of soil materials; rock-forming minerals; weathering and soil formation; factors and progresses of soil formation; composition of soils; physical, physico-chemical, biological and mineralogical properties; soil air, water and temperature; soil organic matter; soil organisms and their activities; nutrients present in the soil; management of saline, alkali and acid soil; soil fertility status; source, characteristics and application of manures, fertilizers, soil amendments and soil conditioners; principles of soil classification and land utilisation; soils of India.

ES.104/SSAC.150 Analysis of Soil, Plant and Water (1L + 4P) II

Errors of observation and sampling; sampling procedures for soil plant and water; redox, metal and hydrogen ion indicators; principles of volumetric and gravimetric analysis; complexometric reaction; absorptiometric and flame emission methods; pH and conductivity measurements; quality rating of irrigation water; total elemental analysis of soils; ashing, digestion and analysis of plant samples; water analysis.

ES.105/SSAC.155 Soil Biology in Relation to Soil Fertility and Pedogenesis (3L + 1P) II

Soil as a biological habitat; distribution and types of soil organisms and their significance in soil formation, aggregation and soil fertility; organic matter in soil, soil enzymes and their significance; biological equilibrium in soil.

ES.106/SSAC.206 Soil Chemistry and Plant Growth (3L + 2P) II

Essential nutrients for plant growth; nutrient requirements of crops. Soil colloids and productivity; chemistry of soil organic matter, fixation and release of ions; mechanisms of ion absorption and uptake; soil solution; movement of ions from soil to plant root; cation exchange capacity of plant roots; factors affecting nutrient absorption; nutrient mobility; adverse soil conditions; soil acidity and liming; acid sulphate soils, soil salinity and alkalinity; chemistry of water-logged soils; toxic substances in soils; transformation of nutrient elements in soil crop system methods for assessment of soil fertility; soil tests and significance of nutrient fractions, concept of critical level, targetted yield and multiple regression techniques in soil test-crop response relationship; nutrient utilisation efficiency; chelation, coating and organic matter in relation to nutrient availability; crop growth and nutrient relations.

ES.107/AP.230 Soil Water **(3L +1P) I**

Structure and physical properties of water; state of soil water, its retention by different forces, free energy concept of soil water. Soil-water interactions. Application of poiseuille's law, Darcy's law, Laplace's equation in flow-problems. Concepts of unsaturated flow and solutions to some unsaturated flow problems, infiltration, redistribution and evaporation of soil water. Application of irreversible thermodynamics to soil water movement. Simultaneous water and solute movement. Thermal regimes and soil water movement. Soil water balance, measurement of hydrophysical properties and its variability in the field, internal drainage and evapotranspiration.

ES.108/SSAC.153 Physical Chemistry of Soils **(4L + 2P) II**

Goldschmidt's laws of crystal chemistry; principal silicate structures; physical chemistry of weathering of minerals; nature and properties of organic and inorganic constituents of soils; activity of ions in soil systems; ion exchange and fixation; formation and properties of acid, alkaline, saline and sodic soils; oxidation and reduction phenomena in soils.

ES.109/AP.111 Climatology **(3L) I**

Weather and climate; Climatological elements; seasonal distribution over latitudes. Climatic classification, Koppen and Thornthwait systems; humid and dry climates; continental, maritime and desert climates. Climatology of India; the monsoons; length of dry, degree days, temperature; rainfall and its variability; arid and semi-arid regions; dust storms. Aridity and moisture indicates atmospheric and soil drought. Climatological factors-their effect on pests and diseases, crop growth and yield.

ES.210/PP.250 Stress Physiology **(2L + 1P) I**

Resistance to heat, drought, frost and salinity.

ES.211/Ag.201 Crop Geography and Ecology **(3L) I**

Scope; factors (physical and social) determining crop distribution; classification of climate; bioclimatic zones, physiological limits of cropy yield and variability in relation to the ecological optimum; adaptation; humidity provinces; photo and thermoperiodism; geographic distribution of crop plant; growth and development; relationship of developmental physiology; manipulation of developmental physiology of crops.

ES.212/PP.253 Photobiology (2L) II

Photomorphogenesis, phototropism. Utilisation of light energy in photosynthesis, effect of long and short-wave irradiation on growth, physiological basis of radiation sensitivity.

ES.113/MPP.104 Introductory Plant Pathology (3L + 1P) I

Historical account of plant diseases by fungi, bacteria, viruses, phanerogamic parasites, non-parasitic diseases etc. and their economic importance; classification of plant diseases, principles of plant disease control, hostparasite interaction; some important fungal diseases of economic plants and their control. Symptomatology, transmission, purification, serology and electron-microscopy of viruses, some important viral diseases of crop plants and general method of control including seed certification; bacterial taxonomy and identification of plant pathogenic bacteria, nutrition and growth of bacteria, physiology of host parasite interaction including symptom development, epidemiology and control of some important bacterial diseases.

2

ES.214/MPP.206 Plant Diseases Epidemiology, Forecasting and Assessment of Losses (2L) III

Epidemiology, factors governing epidemics, artificial and natural control of epidemics, prediction of epidemics, forecasting (warning) services, basic research for development of warning services; disease intensity and yield loss relationships, methods of estimation of losses due to plant diseases.

3

ES.215/Ent.209 Pest Management (2L + 1P) III

The concept and history of pest management, ecological aspects of pest management, the socio-economic aspects of pest management, tactics of plant resistance, parasitoids, predators, diseases, use of insecticides, attractants, repellants, sampling and measuring for economic levels of damage, analysis and modelling for pest management, pest management in major crops like sugarcane, cotton, paddy sorghum and maize, decision making in pest control and cropping systems, ecosystem, agrosystem, succession and incidence of crop pests and influenced by biotic and abiotic factors, life-table studies, pest management in future.

ES.216/MB.201 Microbiology of Food and Water-I (2L + 1P) II

Food and their composition; sources of microbes; psychrophils, mesophils, halophils, thermophils, spore formers, pH tolerance; microflora of meat, fish, egg, fruits, vegetables, juices, bread and pastry, canned foods, methods of food preservation; detection of micro-organisms in food; micro-organisms in food production, food spoilages, micro-biology of water.

ES.117/AC.101 Introductory Pesticide Chemistry **(3L + 1P) I**

Introduction, classification, historical development, nomenclature, chemistry of a few important pesticides viz. DDT, Parathion etc. Studies on organic functional group found in pesticidal molecules. Chemistry of natural products such as carbohydrates, terpenoids, steroids, alkaloids and their importance in agriculture. Formulation of pesticides, safe handling and applications. Studies on safety evaluation, regulatory measures as per insecticides act. Bureau of Indian Standards specifications on important pesticides.

ES.118/AP.210 Evapotranspiration **(3L + 1P) III/Biennial (Even Year)**

Basic laws of radiations; interaction and plant environment; energy balance in atmosphere-crop canopy; the atmosphere near the ground. Theories of evapotranspiration and their comparison. Application under different agro-climatic conditions; potential and actual evapotranspiration-influence of micro climatic, plant, soil and cultural factors. Techniques of lysimetry in measuring actual evapotranspiration. Yield functions; water use efficiency and irrigation scheduling based on evapotranspiration. Advanced techniques for measurement of radiation and energy balance.

ES.119/AE.131 Environmental Engineering for plants and animals **(3L) I**

Variation of atmospheric pressure and temperature with height, energy transfer processes in the atmosphere and soil environment, electromagnetic wave spectrum, energy co-efficients, quantitative evaluation of energy balance equation, plant response to environmental factors, physiological and biochemical basis for responses of animals to climate. Engineering modification of environment.

ES.120 Environmental Pollution **(3L) III**

Definition and sources of pollution; Different types of pollution-Air, water and soil, pollution and their sources and effects on biosphere; fuel and atmospheric pollutants; sources and diffusion of SO_2 CO, CO_2, CFC, CH_4, NO_x in atmosphere, particulates and heavy metal in air; sampling and analysis techniques; type and sources of water pollution; waste water and its treatments; nitrates, heavy metals and pesticide residues in surface and ground waters; sampling and analysis techniques. Sources of soil pollution; nature of pollution and their harmful effects; solid wastes and their disposal; use of land for waste treatments and disposal; radioactive waste and their disposal; Inter-relationship of crop and animal production systems and air, water and soil pollution in different ecosystems.

ES.299 Seminar **(1L)**

Core Courses:

Within the discipline

ES.100, ES.101, ES.102, ES.120, ES.109/AP.111 and ES.211/Ag.201.

XII Genetics

Major Fields : Plant Breeding
Genetics

Minor Fields : A student majoring in one of the above fields may elect to take a minor in another of these fields which are recognised as a major for the discipline. But every student shall take not less than one minor (9 credits of course work) in another supporting major field from discipline such as:

Agricultural Physics
Agricultural Statistics
Agronomy
Biochemistry
Entomology
Environmental Science
Horticulture
Microbiology
Molecular Biology and Biotechnology
Mycology and Plant Pathology
Plant Physiology
Soil Science and Agricultural Chemistry

DESCRIPTION OF COURSES

Gen.100 Elements of Genetics (3L + 2P) I

Introduction: History of Genetics, scope of the course, Reproductive cycle of some model genetic organisms: Drosophila, maize, Neurospora, yeast, bacteria, virus, man. Cell division: mitosis and meiosis. Genetic material: nucleic acids-chemical composition, structure, biological significance and replication. Mendelian principles: I. Segregation, Mendel's experiments. Probability and statistical testing. Mendelian principles: II. Independent assortment.

Gene interaction: determination of family size in experiments, dominance relations and multiple alleles. Environmental influence on gene expression. Sex linkage; chromosomal theory of inheritance; sex determination. Linkage and recombination: detection of linkage, linkage groups, four strand crossing over. Gene mapping: two-point and three point crosses, F2 data, tetrad analysis. Recombination and mapping in bacteria; conjugation, F factor, sexduction, generalised transduction, specialised transduction; transformation. Recombination and mapping in man. Concept of gene and allele; genetic fine structure. Gene mutation; detection; induction; mechanism; mutator genes. Chromosomal aberrations. Variation in chromosome number, Extra-nuclear inheritance. Quantitative inheritance: multiple factors, Population genetics: gene frequency. Hardy-Weinberg equilibrium, changes in gene frequencies. Function of genetic material: DNA and RNA coding; sequence analysis; genes to proteins-information transfer and protein synthesis. Gene regulation; inducible and repressible enzymes; attenuation; gene regulation in eukaryotes. Gene manipulation; restriction enzymes, splicing of DNA; plasmid vectors; DNA libraries; future prospects.

Gen.100A Basic Biology and Genetics (2L + 2P) I

Characteristics of living systems as exemplified by micro-organisms, plants and animals; functional aspects of morphology and life cycles of maize, Drosophila and *Escherichia coli*, the cell, mitosis and meiosis; Mendel's work; chromosomal basis of inheritance; gene interaction; linkage and linkage maps; multiple alleles; continuous variation and population structure; variation and evolution of new organisms; variability and its basis, origin of variability in nature and by artificial means.

Gen.105/MBB.100 Molecular Genetics-1. (Genetics and Regulation in Prokaryotes) (3L + 2P) I

Prokaryotes as genetic system; Sources of variation; Methods of genetic analysis; Prokaryotic chromosomes, plasmids, chromosome mapping, conjugation; Transformation and transduction; Operon concept; Positive and negative control of gene expression; Genetic code; Transcriptional control; DNA replication; Molecular mechanism of recombination; Induced mutagenesis and repair.

Gen.110 Principles of Cytogenetics-I (3L + 2P) I

History of Cytogenesis. Chromosomes: chromosomal basis of inheritance, prokaryotic and eukaryotic chromosomes, mitotic and meiotic chromosome, karyotype analysis, chromosome banding pattern and fine structure; Different forms of chromosomes and their functional significance. Lampbrush chromosomes, Polytene chromosomes, B chromosomes and sex-chromosomes. Cell division: Mitotic cell cycle, chromosome cycle and chromosome movements; behaviour of chromosome during meiosis, sexual and asexual reproduction, consequences and significance, mechanisms and theories of crossing over, cytological basis and role of synaptonemal complex. Structural variation in chromosomes: nature, cytogenetical consequence and their uses-deficiencies, duplications, inversions and interchanges. Numerical variation in chromosomes: Sources and consequences; euploidy and aneuploidy-classification, cytogenetics, evolutionary significance and use in theoretical and applied research. Synthesis of natural and new polyploids, haplontic-diplontic barriers and means to overcome them. Chromosomes and trends of organic evolution.

Gen.111 Seed production Principles and Practices (2L + 2P) I

Theory: Seed as basic input in agriculture; quality concept in seed production, classification of crop plants in relation to mode of reproduction; flowering in crop plants, its modification for hybrid seed production; seed setting, its improvement in insect pollinated plants; effect of environment before harvest on seed quality; genetic purity, its concept and importance in seed production; life span of varieties and factors responsible for their deterioration and shift in their genetic make up; prevalence of natural crossing in crop plants; isolation requirements for seed production; steps in the breeding, release and multiplication of varieties, composites and hybrids; seed quality control-systems and organisation, seed certification, its philosophy, purpose and procedure; seed act, its provisions, rules and regulations; suitable seed production areas, the concept of "seed village"; seed production procedures in cereals, millets, pulses, fibre and forage crops, oilseeds and vegetables; agencies responsible for seed production, seed industry in India.

Practical: Practical field work on the production practices of different crops with particular reference to maize, jowar, bajra, cotton, pulses and vegetable crops, study of morphological and seed characters featuring in varietal description of important crops; filling forms of seed growing contracts; field inspection of different seed crops at various stages of growth; record keeping; visit to quality control laboratories and seed production fields.

Gen.120 Elements of Plant Breeding (3L + 2P) II

The science of plant breeding; domestication of plants and centres of diversity; historical aspects and genetic basis; modes of reproduction: sexual, asexual, apomixis, apospory, apogamy, parthogenesis, polyembryony, Floral biology in relation to selfing and crossing techniques, self and cross pollinated groups of plants, sterility-functional, generational, environmental, heterostyly, potandry, protogyny, genic, chromosomal and cytoplasmic sterility; haplontic and diplontic sterility, self-incompatibility; natural crossing; methods of plant breeding in self pollinated, predominantly cross pollinated, dioecious and vegetatively propagated plants; variability-its nature and origin; introduction, selection-pure line selection-primary and secondary selection, mass selection, clonal selection; chimeras and graft hybrids; hybridization; choice of parents, handling of hybrid material for isolation of superior varieties, pedigree selection, backcross and other methods of breeding, role of interspecific and intergeneric hybridization, population improvement procedures, synthetic and composite varieties; heterosis-its genetic and physiological basis and exploitation with examples from important crops; specific breeding programmes aimed at improving yield, quality, resistance to diseases and pests, tolerance to lodging, drought, frost, salinity etc; maintenance of collections, release and registration of varieties, seed production and distribution, seed testing and certification.

Practical: Emasculation, crossing and selfing techniques in various crops, handling of breeding materials and maintenance of experimental records, observations on genetic variability of different characters in crop plants; methods of layout of different types of varietal evaluation trials and analysis of data; organisation of breeding nurseries; creation of artificial disease epiphytotics, insect pest infestation and simulated abiotic stress conditions for screening; formulation of breeding projects.

Gen.140 Seed Testing (2L + 1P) II

Theory: Seed testing with special reference to India, sampling, mixing and dividing; purity analysis-principles and procedures; germination test and its application; quick viability test, moisture determination; testing for trueness to variety; use of tolerance test in seed testing; seed sample storage, seed health tests; issue certificate reports and conducting seed surveys.

Practical: Steps in seed testing; sampling, dividing and mixing purity analysis, identification of weed and crop seeds; germination test, quick (Tetrazolium test); moisture estimation; use of tolerance tables, maintenance and handling of seed testing equipment.

Gen.199 Pro-seminar (1) II/III

Balram
Sharma

Gen.200 Development of Gene Concept (3L) II ←

Pre-Mendelian concepts of physical basis of heredity, Gene concept in classical genetics. Intragenic complementation and recombination in lower and higher organisms. Fine structure of gene. Genetic control of metabolism, gene-protein relationship. Nature of genetic material and its replication. Transfer of genetic information; transcription and translation. Coding mechanism; general and specific nature of the genetic code, analysis of code dictionary, mutation suppression. Gene structure and expression in eukaryotes. Gene regulation. Laboratory synthesis of gene, Scope and hazards of gene manipulation.

V Arunachalam

Gen.201 Elements of Quantitative Genetics (3L + 1P) I ←

Early thoughts on quantitative inheritance-Mendelian principles-gene, genotypic frequency-Probability laows-Expectation-fixed and random effect models-Genetical distributions. Elementary concepts of matrix theory-solution of equations through matrix theory-linear models. Partitioning of mean effects and variances-Single gene models- genetical parameters (Mather and Jinks approach) and their estimation-Linkage-Epistasis-Components of epistasis and their estimation through generation mean analysis. Inbreeding and heterosis-simple models extension to polygenic situations. Mating systems-diallel, North Carolina and line × tester designs. Concepts of combining ability and their relevance to gene action. Selection: Elementary concepts-Mass, Family, Progeny row selection-single seed descent-Basic concepts of genotype × environment interaction-Approaches to detect them-Quantitative Genetics as a tool for efficient plant breeding-illustrations from crop plants.

V Arunachalam

Gen.202 Advanced Quantitative Genetics (3L + 1P) II

General concepts on gene action-Partitioning of genotypic variance in polygenic systems-Inbreeding-Covariance between relatives-Heritability-Components of gene action-Combining ability-variances of gca, sca-Diallel-Griffing's approach-Multiple cross designs-Three way, four-way, polycross etc.-Various measures of genetic divergence-heterosis-complex mating systems-Gene action, maintenance and utility of genetic variation in relation to some crops, self, cross-and often-cross pollinated. Advance theory of selection. Natural and artificial-

Polymorphisms-asymmetry of response-Selection limits-Quasi-linkage equilibrium-Threshold characters. Selection methods-their theoretical basis-Recurrent and reciprocal recurrent selection-Selection for multiple traits-morphological, physiological, biochemical etc.-disease and insect resistance-Abiotic and other biotic stresses-Concepts of population and their improvement-multi-lines and varietal blends-Recent advances in quantitative genetics and basis of breeding for productivity illustrated through examples from crops.

(Pre-requisite: Gen.201)

Gen.203 Human Genetics (2L) III

History: Genetic variations in human populations; Formation of germ cells; parental development. Mendelian inheritance: autosomal dominant inheritance; autosomal recessive inheritance; X-linked inheritance, Y-linked inheritance. Genetic linkage; gene mapping methods. Karyotype analysis; cytogenetic techniques; anomalies of sex chromosome; Down's syndrome; other abnormalities of autosome number; chromosome breakage and reciprocal transplocation; other structural abnormalities of chromosomes. Antigens and antibodies, the blood groups; the immune system; transplantation problems. The basis of induced genetic changes; mutation and gene expression; exposure to radiations. Twinning. Behaviour and intelligence. Genes in populations. Genetic counselling. The manipulation of man's genetic system. Evolutionary divergence of chromosomes among primates.

Gen.204 Mutagenesis (3L + 1P) III

History of experimental mutagenesis. Nature of mutations. Spontaneous mutations: mode of induction. Physical mutagens; properties and effect of ionizing and ultraviolet radiations, RBE and LET, direct and indirect effects. Chemical mutagens; nature of chemical reactions, mode of action and classification of various chemical groups. Repair of mutagenic damage. Genetic sieves in mutation induction. Screening techniques and selection procedures of induced mutations: test systems. Biological and environmental parameters influencing mutagenic efficiency. Application methodology of mutagens and modification of their action. Specificity of mutation induction and directed mutagenesis. Somaclonal variation-Mutator systems. Mutation breeding in plants, animals and microorganisms. Use of mutagens as carcinostatic agents. Scope and achievements of mutation breeding. Environmental mutagenesis. Comparative assessment of various types of mutagens.

Gen.207 Breeding for Stress Resistance (3L) III

Definition and nomenclature of stress, nature of fungal, bacterial, viral diseases, insect pest problems; Classification of resistance and terminological aspects; basis of resistance in plants, mechanisms of disease and insect resistance and factors affecting host reactions, gene for gene hypothesis, host-parasite relationship, variation in pathogen and host; methods of estimation of resistance, screening techniques for breeding materials and creation of artificial epiphytotics; sources of resistance, selection for resistance, limits of disease control by genetic means, breeding methods for disease resistance. Abiotic stresses; general consideration; nature of temperature and moisture stresses, soil physico-chemical and nutritional stresses; effects on yield and other plant characters; mechanism of tolerance, role of morphophysiobiochemical characters and their operation in different crops; screening techniques; breeding approaches.

Gen.211 Cell Biology (3L + 1P) II

History of cell biology; cell theory; cell physiology, physico-chemical cellular analysis, prokaryotic and eukaryotic cells, Biochemistry of the cell; Supramolecular organisation and the origin of the cell; cell wall; structure, chemical composition and functions, cell membrane architecture and evolution of membrane models, molecular anatomy and functions; Endoplasmic reticulum: General morphology, microsomes functions and synthesis of E.R; Golgi Complex: morphology, cytochemistry and functions; Lysosomes: Characteristics, analogy between animal and plant lysosomes and functions; Mitochondria: morphology, structure of membranes, molecular organisation and functions, permeability and biogenesis; Chloroplast: molecular organisation, photosynthesis; functional models of chloroplast membrane. The Nucleus: nuclear envelope, cell cycle and DNA replication: Ribosomes; biogenesis of ribosomes and nucleolar functions, ribosomal RNAs.

Practicals: Techniques in Cell biology-microscopy, autoradiography, micro-spectrophotometry, chromatography, electrophoresis, cell fractionation, techniques for preparing materials for cell biological studies.

Gen.220 Crop Cytogenetics (3L) I

Scope of cytogenetics in plant improvement; Genome analysis: use of conventional and modern techniques, morphological, cytological, genetical, biochemical and molecular tools. The species concept: Theory of evolution, isolation mechanisms and criterion of species, major trends in evolution. Evolution of crop plants: Major crop plants of India, their distribution and centres of diversity; Role of cytogenetical factors in the evolution of major crops like wheat, rice, maize, sugarcane, Brassica, cotton, jute, tobacco, potato, tomato; pulse crops, forage crops and cucurbits.

(Pre-requisite: Gen.110)

Gen.231 Breeding for Crop Quality (2L) III

Quality considerations in principal cereals, pulses, oilseeds, fibre, sugar, vegetable and forage crops, variability and inheritance of quality traits, measurement of quality traits and mass screening methods useful in improvement work.

(Pre-requisite: Gen100, 120)

Gen.232/MBB.211/Bio.208 Nucleic Acids (2L + 1P) I

Biosynthesis of nitrogenous bases and nucleotides; Chemistry of nucleic acids; Structure and conformation of DNA and RNAs', DNA topoisomers, tRNA, mRNA and rRNA; Nucleases, endonucleases and related enzymes; DNA sequencing; Chemical synthesis of nucleotides and nucleic acids.

Gen.233/MBB.200/Bio.209 Protein Synthesis (3L + 1P) II

Genetic code: Structure and function of mRNA and tRNA; Ribosome structure and function; Organization and regulation of ribosomal protein and r-RNA genes; Ribosome m-RNA interaction, colinearity protein biosynthesis in prokaryotes and eukaryotes, amino acid activation, polypeptide chain initiation, elongation and termination; Post-translational modifications and their significance.

(Pre-requisite: Gen. 232)

Gen.234/MBB.201/Bio.210 Gene Regulation (3L) III

General control of DNA, RNA, and protein synthesis; Gene regulation in prokaryotes; Gene clustering and operon concept; Mechanism of positive and negative control of gene expression; Translational and transcriptional control of regulatory mechanism of gene expression in eukaryotes; Role of post-transcriptional and post-translational events in gene regulation; Isolation of repressor and characterization of operator.

(Pre-requisite: Gen.105 & 233)

Gen.237 Applied Cytogenetics (3L) III

Application of cytogenetical methods for plant improvement. Location and mapping of genes on chromosomes: Deficiency method. Interchange-genetic consequence, identification of chromosomes involved, all arms marker method, linked marker method. Inversions for location of genes. Trisomics-different types, production, breeding behaviour and location of genes. Monosomics-methods of production, intervarietal substitutions, allelic and non-allellic interactions. Telocentric method of mapping. Relative efficiency of different methods. Application for crop improvement: Duplications-production and use. Multiple interchange- use in producing inbreds, transfer of genes. Balanced tertiary trsomics-use in hybrid seed production. Polyploid methods: Use of auto-polyploids. Haploidy-methods of production and use. Gene transfer by distant hybridization; scope and limitation, methods to overcome barriers-tissue culture. Allopolyploids-synthesis of new crop species and varieties. Alien chromosome addition and substitutions. Chromosomal control of meiotic pairing and induced transfer of alien genetic variation.

(Pre-requisite: Gen.110)

Gen.240 Plant Genetic Resources (2L + 1P) III

Origin of agriculture, crop plant diversity, evolution and distribution, mega and microcentres, exploration and collection of germplasm, priority areas and crops, pattern of variation in field populations, sampling techniques; principles of plant introduction, ecoclimatic homologies, agrestological indices, genetic resources centres, exchange of plant material, quarantine regulations, multiplication and documentation of genetic resources. Conservation and storage, modern gene banks, storage of seed, pollen, tissue culture, woody and vegetative materials; base and active collections, and their storage requirements; international and national storage facilities; threatened resources, evolution in situ and its conservation, genetic reserves.

Gen.241 Concepts in Plant Breeding I (Fundamentals) (2L) I

Plant breeding and its elements; gene pools-sources and their organisation; influence of various evolutionary forces on population structure; importance of breeding of quantitative characters; nature of continuous variation; estimation of hereditary components of variation from generation means and variances and their utility in plant breeding; different mating designs-their limitations and advantages for the estimation of genetic parameters in presence of epistasis, linkage, maternal effects; combining ability and choice of parents; genotype-environment interaction and its role in estimation of genetic parameters and allocation of resources for multi-environment testing; selection for single and multi-characters; genetic advance, expected and realised heritability; correlation and regression analysis, path coefficient analysis, correlated response; indirect selection, selection indices.

(Pre-requisite: AS.120, AS.121, Gen.1000, Gen.120)

Gen.242 Concepts in Plant Breeding II (Selection Schemes) (2L) I

Methods of selection-individual, family, combined and their relative merits; different forms of selection-stabilizing, directional and disruptive and their effect on variation in populations; nature of short and long term responses to selection in experimental populations, Selection limit, asymmetry of response to selection-its causes. Selection schemes in relation to modes of reproduction and types of gene action, various selection methods, their advantages and limitations; breeding of inbred crop species, mass, pedigree, bulk methods and their variants; evolutionary methods of plant breeding, etc. Composite crosses, convergent crossing, choice of parents; population improvement programmes-their requisites, intra population improvement schemes-mass selection and various progeny testing techniques; use of male sterility,polycross nursery; synthetics and composites; unit selection, genetic selection, interpopulation improvement schemes-reciprocal recurrent selection; backcross method of breeding; comprehensive breeding schemes and breeding plans. Methods of breeding of vegetatively propagated annual and perennial plants; genotype × environment interaction with special reference to breeding for specific and wide adaptation; stability parameters, limitations of various stability models, intergenotypic interactions and their exploitation in plant breeding.

(Pre-requisite: Gen.241)

Gen.243 Concepts in Plant Breeding III (Heterosis) (2L) II

Introduction, historical aspects-early ideas on inbreeding and outbreeding, pre- and post-Mendelian ideas about hybrid vigour, Nomenclature and classification of heterosis, development of heterosis concept, evolutionary concept of heterosis, mathematical models of heterosis, heterosis in populations, genetic, biochemical and physiological basis, role of genetic diversity, mitochondrial heterosis, heterosis in heterocaryons, fixation and exploitation, introgressive hybridization, problems and prospects of heterosis breeding.

(Pre-requisite: Gen.242)

Gen.244 Breeding of Field Crops-I (3L) II

Recapitulation of methods of breeding self-pollinated crops, selfing and crossing techniques, pollination practices, incorporation and utilisation of male sterility, origin and genetics, nature of variation, upto date breeding research in wheat, rice, barley, triticale, oilseed, potato, pulses, plantation crops (coconut, oil palm).

Pre-requisite: Gen.241, Gen.242)

Gen.245 Breeding of Field Crops-II (3L) III

Recapitulation of breeding methods of cross-pollinated crops; selfing and crossing techniques; pollination practices; derivation of various kinds of progenies, mode of synthesis of different kinds of hybrids, synthetics, composites; male sterility-its incorporation and utilisation; origin and genetics; nature of variation; upto date breeding research in: maize, sorghum, millet, cotton, tobacco, sugarcane, sugar beet, forage crops.

(Pre-requisite: Gen.241, Gen.242)

Gen.246 Field Execution of Plant Breeding Experiments (1P) II/III

Criteria for measuring the precision and efficiency of nursery and yield trials. Comparative study of various experimental designs, CRD, hill design, honey comb, augmented design, augmented hill designs, compact family block design, RBD lattice-simple squares. Approaches for minimizing effect of soil heterogeneity, local controls, confounding etc. Preparation of seed/plant material for multilocation trials to meet the needs of manual and mechanized handling of field experiments. Mechanization of operations in field experiments. Organisation of seed material and field layout for mechanized sowing of yield trials and nursery plots, study of equipments used for continuous drilling and space planting in wheat, maize, oilseed and pulse crops. Mechanized harvest of yield trials. System of record keeping.

(Pre-requisite: Gen.120)

Gen.299 (a) Plant Breeding Seminar (1) I/III

Gen.299 (b) Genetics & Cytogenetics Seminar (1) I/III

Gen.301 Developmental Genetics (2L)

Early ideas on development. Development and differentiation. Origin of cell heterogeneity in early development. Determination and pluripotentiality. Constancy of the genomic; cytoplasmic regulation of gene expression during development. Genome organization. Genetic studies of regulation in higher organisms. Gene interactions in development. The organisation of development: genetic mosaics; genetic studies of determination; homoeosis and transdetermination; pattern formation within compartments in Drosophila; application of compartment model in other organisms. Intercellular interactions in development. Molecular biology of development; control of gene expression during differentiation and development.

Gen.302 Extranuclear Inheritance (2L) III

Maternal effects; patterns and transmission of cytoplasmic genes; classification of extra-chromosomal genes; origin and evolution of mitochondiral DNA; mitochondrial DNA and male sterility in plants; plastid inheritance; structural and functional organization of chloroplast genome; organisation and genetic expression of plasmids; gene-plasmid interactions; cytoplasmic genetics in perspective.

Gen.303 Topics of Population Genetics (2L)

Hardy-Weinberg Law-dynamics of gene frequency under selection, migration, genetic drift; Subdivision-selection in niches; linkage-fitness; Two and multi-gene systems-polymorphisms, inbreeding; Path coefficient, correlation between relatives; Mixed mating systems, genetic load, co-adapted gene complexes, homeostasis, adaptive organisation of gene pools; Introgression, case studies to illustrate various concepts of population genetics.

Core Courses

(a) For Ph.D. students majoring in Plant Breeding

Gen.202, Gen.237, Gen.342, and Gen.245

(b) For Ph.D. students majoring in Genetics and Cytogenetics

Gen.200, Gen.204, Gen.211 and Gen.237

(c) For M.Sc. students majoring in Plant Breeding

(i) Within the discipline

Gen.100, Gen.110, Gen.120, Gen.199, Gen.201

(ii) Outside the discipline

AS.121, AS.123, PP.100

(d) For M.Sc. students majoring in Genetics and Cytogenetics

(i) Within the discipline

Gen.100, Gen.110, Gen.120, Gen.199

(ii) Outside the discipline

AS.121, Bio.100, PP.100

XIII Horticulture

Major Fields : Pomology
Olericulture
Fruit and Vegetable Preservation
Floriculture

Minor Fields : A student majoring in one of the above fields may elect to take a minor in another of these fields which are recognised as major for the discipline. But every student shall take not less than one minor (9 credits of course work) in another supporting major field from a discipline such as:

Agricultural Economics
Agricultural Engineering
Agricultural Extension
Agricultural Physics
Agronomy
Biochemistry
Entomology
Environmental Science
Genetics
Microbiology
Mycology and Plant Pathology
Plant Physiology
Soil Science and Agricultural Chemistry
Agricultural Statistics

DESCRIPTION OF COURSES

***Hort.100 Basic Pomology (2L + 2P) I**

Layout and establishment of orchard; pruning and training; propagation, climatic requirements and cultivation of major fruits, like mango, banana, citrus, guava, grapes, custard-apple, papaya, apple and stone fruits.

Hort.142 Principles of Vegetable Production (4L + 1P) III

Importance of vegetables; its area and production in India; types of vegetable growing; classification of vegetables; soil and climate factors requirements; heat units and chilling requirements; cultural practices; principles governing vegetable production under glass and plastic houses; nutrients essential for plant growth; manures, chemical fertilizers and their response; irrigation and water requirements; crop rotation, crop succession inter-and mixed cropping; different pests, diseases and their control measures; role of plant growth substances; vegetable seed production and its storage; harvesting, grading storage and marketing; vegetable processing; export of vegetables.

Hort.145 Nutritional Requirements of Vegetable and Ornamental Crops (3L + 1P) I

Factor affecting nutrition, nutrient uptake and removal; techniques for evaluating nutrient requirements; role of micro-nutrients and their response; deficiency and toxicity disorders associated with different minerals, application of different nutrients; soil and foliar nutrient levels related to crop production.

*Hort.151 Basic Floriculture (2L + 1P) II

Importance and scope of Floriculture; various type of gardens; principles of garden design and maintenance; garden plants and materials such as lawns, trees, shrubs, creepers, hedges; water garden; rockeries; summer, winter and rainy season annual flowers, roses, chrysanthemum, bulbous plants and orchids and their uses; plant propagation methods.

*This course is meant for students not majoring in Floriculture.

Hort.152 Fundamentals of Floriculture (3L + 2P) I

History, scope and development of the industry; styles of gardens and garden design; uses and cultivation of ornamental trees, shrubs, climbers, bulbous plants and flowering annuals; preparation and maintenance of lawns.

Factors governing growth and flowering of ornamental plants, layout and management of nursery of ornamental plants; propagation, methods and structures; green-house plants, their uses, cultivation and maintenance, dahlia, chrysanthemum, gladiolus and bougainvillea, their types and varieties and cultivation in ground and pots; catci, succulents, orchids and water plants and their cultivation; roses, their origin, classification, propagation and cultivation for garden and cut flowers; cutting, grading, packaging and marketing of cut flower crops such as aster, carnation, chrysanthemum, gladiolus, narcissus, orchids and antirrhinums for internal and foreign market; prolonging the life of flowers.

Hort.153 Breeding of Ornamental Plants (3L + 2P) II

History of improvement of ornamental plants; role of introduction and selection on domestication of wild plants; variation and genetic mechanisms associated with flower characters like doubleness and colour in important annuals, bulbs and shrubs; pollination requirements and breeding systems met within ornamental plants and factors governing seed set; methods of breeding suited to seed and vegetatively propagated plants; role of incompatibility, sterility factors, polyploidy and mutations in the evolution of new varieties.

Role of heterosis and its exploitation; production of F_1 hybrids and utilisation of male sterility; hybrid seed production; techniques in evaluating breeding lines and development of new varieties; review of the important work done in India and abroad in the improvement of roses, chrysanthemum, dahlia, gladiolus, amaryllis, lillies, sweet pea, petunia, stocks, antirrhinum, marigold, zinnia, pansy, phlox, carnation, bougainvillea, hibidscus, etc.

(Pre-requisite: Gen.100 and 120)

Hort.201 Fundamentals of Fruit Production **(4L + 1P) I**

Soil and climatic adaptation; winter injury in relation to specific fruits; occurrence of frost and protection against frost; water requirements of fruit crops, intake and utilisation of water; response of fruit plants to varying conditions of soil moisture and humidity and pathological conditions associated with excess and deficiency of moisture; soil management practices; manures and manuring; systems of cultivation, intercrops, cover crops and mulching; growth and fruiting habits; pruning-principles, severity, methods, season of pruning with special reference to particular fruits, training methods; unfruitfulness associated with internal and external factors, factors concerned with development of fruit, fruit setting as an orchard problem, alternate or irregular bearing, fruit thinning, and fruit drop; marketing of fruits, their picking, grading, packing and transport; local market surveys.

Hort.202 Nutritional Requirements of Fruit Crops **(3L + 1P) I**

A survey of problems of plant nutrition in fruit crops; nutritional requirements of fruits; factors affecting nutrition; methods and techniques for evaluating nutrient requirements of horticultural crops; response of plants to chemical and physical aspects of their nutritional environment; role of micro-nutrients; visual symptoms of deficiency and methods of determining mineral deficiency in horticultural crops.

Hort.203 Breeding of Fruit Crops-I **(3L + 1P) II**

Principles and methods of breeding fruits; causes of variation in fruit crops; induction of polyploidy and mutation through colchicine, irradiation and other methods; production of seedless varieties; improvement of fruits by selection and hybridisation; objectives and techniques of hybridisation in fruits like banana, citrus, grapes, mango and apple.

(Pre-requisite: Gen.100)

Hort.204 Plant Propagation **(2L + 2P) II**

Fundamental principles of plant propagation by seed, cutting, layering and graftage; reciprocal influence of stock and scion; stock-scion incompatibility; root stocks for fruit crops; use of plant regulators in propagation; techniques of propagation and equipment.

Hort.211 Growth and Development **(3L + 2P) II**

Studies in growth and development, modern trends in the field.

Growth: The cell-structure, function of cell organells, physiological aspects of cell growth and cell division; plant regulators-auxins (natural and synthetic), gibberellins, kinetins (natural and synthetic); inhibitors (natural and synthetic); metabolic inhibitors; effect of these regulators on plant morphogenesis.

Development: Germination, physiology and biochemistry; juvenility and senescence; phasic development; morphogenesis; flowering; sex expression; fruiting, simplified technique of hybrid seed production-Resistance breeding-for disease, insect and nematode resistance, multiple disease resistance in vegetable crops-Mutation breeding-Polyploidy breeding-Interspecific hybridization-Breeding procedures for asexually propagated vegetable crops-Biotechnological tools in vegetable breeding-Breeding of vegetables to suit protected environment.

Hort.231 Post Harvest Technology of Horticultural Crops **(3L + 3P) II**

Harvesting, sorting, grading, packing and transportation of fresh fruits, vegetables and flowers, physical, physiological and biochemical changes after harvest, pretreatments; refrigeration and storage; control, modified and hypobaric storage; simple storage structure and design; spoilage/disease; physiological disorders and chilling injury; marketing and quality control of fresh fruits, vegetables and flowers.

Hort.232 Post Harvest Technology of Horticultural Crops **(3L + 3P) II**

Processing of horticultural crops includes containers, equipment and techniques in canning, solar drying and dehydration, freezing; fruit and vegetable juices, their extraction, clarification, preservation and storage, fruit beverages and juice concentrate; role of sugar and pectin in preparation of jam, jelly, marmalade and allied products; preserve, candy and confectionery; pickle, sauce and ketchup, processing of flowers into various products, and plant sanitation.

Hort.241 Breeding of Vegetable Crops-I **(4 L+ 1P) I**

Importance of vegetable breeding-history and evolutionary aspects of vegetable breeding and vegetables-genetic architecture. Techniques of selfing and crossing-breeding systems and methods-breeding through selection procedures-Hybridsation-heteroris breeding, male sterility, self-incompatibility, sex forms as with growth and production; standard varieties; seed production techniques, pests and diseases.

Hort.243 Principles and Techniques of Vegetable Seed Production **(4L + 1P) II**

Seed morphology and development in vegetable seeds; raising of crops for vegetable seed production; environmental factors related to flowering/bolting in vegetable crops; pollination systems and breeding techniques related to vegetable seed production in different crops; isolation distances; roguing; selection procedures and criteria for seed production; hybrid seeds.

Hort.244 Summer Vegetables (4L + 1P) II

Origin, distribution and botanical relationship, general morphology and taxonomy; standard varieties and F_1 hybrids, their evolution and characteristics, basic principles of production, effect of environmental factors to the growth and yield; seed production, insect pests and diseases and their control measures; and nutritive value and uses of summer vegetables.

Hort.245 Winter Vegetables (3L + 2P) I

Origin, distribution and botanical relationship between different winter vegetable crops; principles in growing of these crops; environmental factors associated with fruit-set, fruit growth, fruit ripening and abscission; root differentiation, its growth and development; dormancy of seed and buds; tuber and bulb formation.

Hort.253 Landscape Gardening (2L + 1P) I

Principles of Landscape Gardening & formal and informal styles of gardens. Types of gardens (Hindu, Buddhist, Persian, Mughals, Japanese and English gardens). Features of garden paths, roads, edges, lawns, fountains arches pergola, shrubbery, topiary, flower beds, hedges, flowering and avenue trees, rockery, conservatory, glass and green house, hanging pots, bird baths, tea houses etc. Principles and practices of landscape designs for home gardens and public parks. Study and uses of plant materials and other components in combination for landscape effects. Layout and maintenance of lawns.

Hort.254 Indoor Plants (3L + 1P) III

Importance and use of house plants; Effect of factors like light, temperature, humidity, ventilation, watering, nutrition and potting media in house plant growing; Plant care including training, grooming, gardening, summer care; propagation of house plants, Diseases and pests; Description of important types of house plants i.e. flowering, foliage, cacti and succulents; containers for house plants including special features like dish gardens, terrariums and hanging baskets.

Hort.255—Laboratory Techniques for Horticultural Crops (1L + 2P) I

Sampling, preparation and storage of samples, preparation of standard solutions, measurement of maturity indices, refractometry, viscosity, pH and buffers, colorimetry, chromatography, flame photometry, conductivity, electrophoresis, fluorimetry etc.

Hort.301—Breeding of Fruit Crops-II (3L + 1P) III

Origin, recent history of improvement, cytotaxonomic back ground, modern breeding objectives, techniques and systems; inheritance of characters, breeding for specific characteristics; early evaluation; achievement and prospects in fruit crops like mango, grape, citrus, banana, papaya, and temperate fruits like apple, peach, pear and almond etc; Breeding for rootstocks;

Innovative approach for fruit crop improvement, nomenclature, registration, patent and rules for release of varieties.

Hort.302 Vegetable Breeding II (A) (3L + 1P) II

Origin, cytogenetics and improvement of cross pollinated vegetable crops i.e. cole crops, cucurbitaceous crops, bulb crops and root crops.

(Pre-requisite: Hort.241)

Hort.303 Vegetable Breeding II (B) (3L + 1P) III

Origin, cytogenetics and improvement of self pollinated vegetable crops i.e. Solanaceous crops, Leguminous crops, okra, potato and lettuce.

(Pre-requisite: Hort.241)

Hort.304 Post-Harvest Technology of Horticultural Crops (3L + 1P) I

Physiology and biochemistry of respiration, ripening and senescence effect. Bio-synthesis effects of ethylene in horticultural crops. Physiological disorders and chilling injury of horticultural crops during storage. Enzyme nomenclature and classification, enzyme kinetics. Importance of enzyme in post harvest technology. Recent advances in pre and post harvest treatments of horticultural crops. Advances in fermentation biotechnology. Utilization of horticultural wastes for value added products. Recent advances in food processing industry with special reference to aseptic processing and packaging, cryogenic freezing etc.

Hort.305 Commercial Floriculture (3L + 1P) II

Scope and importance of commercial floriculture in India. Production techniques of ornamental plants like rose, chrysanthemum, orchid, carnation, gladiolus, jasmine, dahlia, tuberose, etc. for domestic and export markets. Growing of flowers under protected environments such as glass-house, plastic house etc. Production of F_1 hybrid seeds for commercial flower growing. Post harvest technology of cut flowers in respect of commercial flower crops. Production of dry flowers.

Hort.307 Advanced Landscape Gardening (3L + 2P) III

Origin and history of Landscaping: Principles of gardening (formal and informal), types and elements of designs, cultivation and uses of different plant materials, (trees, shrubs, climbers ground covers, shade loving plants, annuals, bulbous perennials and potted plants) in combination landscape effects for plains and hills. Different features of gardens edging; arches, pergolas, rock gardens, terrace gardening, paved garden, dry wall, borders, water garden, marsh or bog garden herbaceous shrubbery, borders roof garden, green house conservatory and lath houses. Garden adornments like birth bath, fountain, sundials, floral clock, lighting ornamental latern stones, statues, urns, garden furniture and plant stands. Principles of art and bio-aesthetics in landscape design and composition. Landscaping of places like-cities, towns, countryside, different roads, railway tracks, religious places, industrial area, houses, embassies, office, hostels, archaeological monuments, riverside etc., Multistoreyed building with emphasis on terrace gardening. Interior decoration of hotels and buildings. Sources and nature of air pollutants, landscape ecology. Monitoring and mapping of pollution with the help of plants. Master plans of cities in relation to parks and recreation sites.

Hort.308 Advances in Growth and Development of Horticultural Crops (3L) III

Regulation of plant growth as affected by various cultural practices; control of juvenility; plant growth and productivity in relation to photoperiod, temperature and other environmental factors. Stress Physiology in relation to drought, frost, heat and salts. Role of plant growth regulators on seed and bud dormancy, rooting of cuttings flower initiation, fruit set and development; sex expression and induction of parthenocarpy; physiological basis of flower and fruit drop, fruit thinning, fruit maturity and ripening.

Hort.299 Seminar (1) I/II/III

Core Courses:

A. For M.Sc.

(1) For basic courses in Horticulture (Hort.100, 131, 141 and 151, except those in the field, in which the student is majoring or those fields taken as a minor).

(2) Majoring in Pomology: Hort.101, 201 and 204 (14 Cr.)

(3) Majoring in Fruit Preservation: Hort.132, 231, 232 (16 Cr.)

(4) Majoring in Olericulture: Hort. 142, 244, & 245 (15 Cr.)

(5) Majoring in Floriculture: 152 and 153 (10 Cr.)

B. For Ph.D.

(1) The Core courses for the Ph.D. degree would be the same as those for the M.Sc. students except that they would not be required to take the basic courses Hort.100, 131, 141 and 151.

(2) In addition to the Remedial Courses prescribed for the non-agricultural students, add the following courses of 10 credits as compulsory additional requirements for all Ph.D. students in the discipline of Horticulture, who have done M.Sc. degree in Food Science/Food Technology without a B.Sc. (Ag.) or B.Sc. (Hort.) degree preceding the Master's degree.

(1) Hort.100-Basic Pomology (2 + 2)

(2) Hort.141-Basic Vegetable Growing (2 + 1)

(3) Hort.151-Basic Floriculture (2 + 1)

XIV Microbiology

Major Fields :	Soil Microbiology Algology Agricultural Bacteriology
Minor Fields :	A student majoring in one of the above fields may take a minor in another field recognised as a major field in the discipline, but every student shall not take less than one minor (9 credits of course work) in another supporting major field outside the discipline of Microbiology such as:

Agricultural Physics
Agronomy
Biochemistry
Environmental Science
Genetics
Mycology and Plant Pathology
Plant Physiology
Soil Science and Agricultural Chemistry
Agricultural Statistics

DESCRIPTION OF COURSES

MB.100 Microbiology-I (3L + 2P) I

History and development of Microbiology; study of microbes; the microscopic and cultural methods; the procaryotic and eucaryotic cell; the bacteria-cytology and physiology; classification of bacteria; the fungi and cytology, mutation and metabolism; life cycle and importance; the viruses; and rickettsiae; protozoa; algae; soil microbiology, food microbiology; control of microorganisms; antibiotics; disease, resistance to disease; microbial genetics.

MB.101 Soil Microbiology (3L + 2P) I

Soil micro-organisms; methods of studying soil micro-organisms; respirometric technique; burried slide; fluorescent antibody, selective enrichment, decomposition of organic matter, humus formation; synthesis and metabolism of polysachharides in soil; breakdown of pesticides; the nitrogen cycle-ammonification, nitrification, denitrification, non-symbiotic and symbiotic nitrogen fixation.

MB.102 General Morphology and Ecology of Algae (3L + 2P) I

Major groups of algae and their characters; organisation; reproduction and life history, cell organisation; cell constituents; algal associations; cyanophages; colourless and fossil algae; ecology of algae.

MB.200 Microbiology-II (2L + 2P) II

Microscopes and cytology; microbial systematics; serology; methods of preserving bacteria; assay methods with micro-organisms; media, preparation and use; bacteriophage.

MB.201 Microbiology of Food and Water-I (2L + 1P) II

Food and their composition; sources of microbes; psychrophiles, mesophiles, halophiles, thermophiles, spore formers, pH tolerance; microflora of meat, fish, egg, fruits, vegetables, juices, bread and pastry, canned foods, methods of food preservation; detection of micro-organisms in food; micro-organisms in food production, food spoilages, microbiology of water.

MB.202 Microbiology of Food and Water-II (2L + 1P) III

Microbiology of milk, pasteurisation, milk spoilage, microbiological methods for examination of milk and milk products; microbiological examination of water; procedures for water purification, sewage treatment; water pollution; biological oxygen demand; nuisance bacteria in water.

MB.203 Soil Microbiology-II (2L + 2P) II

Sulphur metabolism in water and soil; transformation of phosphorus in soil, transformation of iron, transformation of other elements Mn, Zn, Cu, etc.; soil as an ecological system.

MB.204 Soil Microbiology-III (2L + 2P) II

Biochemistry of symbiotic and non-symbiotic nitrogen fixation; nodulation of legumes; symbiotic fixation of nitrogen by non-legumes; phyllosphere and rhizosphere micro-organisms; practical aspects of symbiosis; problems associated with inoculation.

MB.205 General Metabolism of Algae (3L + 1P) II

Growth and synchrony; nutrition; energy relations; fermentation; respiration; photosynthesis; extra-cellular products and toxicity; amino-acids and proteins; nucleic acids; genetics and mutation.

MB.206 Industrial Microbiology (2L + 2P) I

Present scope, factors contributing to the success of an industry based on microbial fermentation; molasses; ethanol fermentation, yeasts and their propagation; glycerol; acetone-butanol, acetone-ethanol fermentation, acetic, lactic, gluconic and citric acid fermentations; antibiotics; enzymes, riboflavin, vitamin B_{12}, gibberellin etc.

MB.207 Growth and Metabolism-I (2L + 2P) II

Growth of micro-organisms; general form of the growth curve; enumeration of the micro-organisms; synchronous culture; continuous culture; oxidative pathways; the Krebs and glycolytic cycles; electron transport systems in micro-organisms; fermentative metabolism.

MB.208 Growth and Metabolism-II (2L + 1P) III

Nitrogen metabolism in micro-organisms; physiology and biochemistry of nitrogen fixing micro-organisms; protein breakdown by microbes; deamination; transmination; utilisation of different N-sources by bacteria; ammonia, urea, nitrates, amino acids, biuret; autotrophic nutrition of the different groups and their over-all processes; difference between bacterial and algal photo-autotrophy, storage of energy in autotrophy; CO_2 fixation by ribulose 1:5 diphosphates; synthetic activities of microbes; synthesis of antibiotics; the metabolism of pesticides in soil.

MB.209 Algae in Agriculture and Industry (2L) I

Industrial uses of algae; agricultural uses and algae in sewage and water supplies.

MB.299 Seminar

Core Courses

A. For M.Sc.:

(1) Within the discipline	MB:100 and 101 (10 Cr.)
(2) Outside the discipline:	Bio. 100 (4 Cr.)

B. For Ph.D.	As prescribed for M.Sc.

XV Molecular Biology and Biotechnology

Major Field : Molecular Biology and Biotechnology

Minor Field : A Ph.D. student majoring in the above field shall take not less than two minors (9 credits course work each) and a M.Sc. student not less than one minor (9 credits course work) in discipline such as:

Agricultural Statistics
Biochemistry
Entomology
Environmental Science
Genetics
Microbiology
Mycology and Plant Pathology
Plant Physiology

DESCRIPTION OF COURSES

MBB.100/Gen.105 Molecular Genetics-I (Genetics and Regulation in Prokaryotes) (3L + 2P) I

Prokaryotes as genetic system; Sources of variation; Methods of genetic analysis; Prokaryotic chromosomes, plasmids, chromosome mapping, conjugation; Transformation and transduction; Operon concept; Positive and negative control of gene expression; Genetic code; Transcriptional control; DNA replication; Molecular mechanism of recombination; Induced mutagenesis and repair.

MBB.101 Molecular Genetics-2 (Molecular Eukaryotic Genetics) (3L) II

Eukaryotes as genetic system; Sources of variation; Methods of genetic analysis; Conventional and modern methods of gene identification and isolation; Conventional and molecular mapping of chromosome; Eukaryotic genome organisation, C- value, Cot value, chromatin structure, chromosome replication; Synthetic chromosome; Structure and organisation of eukaryotic gene; ADH gene, rRNA gene, histone gene and immunoglobin gene; Transcription and post transcriptional modification; Translation and post translational; modification; Regulation of cell division, differentiation and morphogenesis.

(Pre-requisite: MBB.100)

MBB.104 Origin and Evolution of Molecules and Life (1L) II

Architecture of earth and solar system and geological and atmospheric conditions of early earth; Origin of micro and macro molecules and self assembled systems; Protenoid early systems; Laboratory simulation; Evolution of organisms based on present day molecules and genetic code; Fossil record of early molecules and life; Time table of origin of life; Diversity of present day living forms; Modern concepts of evolution; Diversity and conservation of macromolecular information among present general and archaic life forms; Extra terestrial molecular isolation.

MBB.105 Molecular Genetics-3
(Molecular Genetics of Plasmid and Mobile Elements) (2L + 1P) II

Plasmids and episomes, their general structure and variation in size; Determination of plasmid replication, maintenance, stability, copy number; Hot lethal genes; Determinants of incompatibility and fertility inhibition; Conjugative mobilization genes and genes for surface exclusion, integration, excision and amplification; Plasmid transformation requirements; structure, organisation and functioning of insertion and transposon elements; Plasmids as vectors; Plasmid carrying genes of economic importance.

MBB.106 Molecular Genetics-4
(Molecular Genetics of Bacteriophages) (2L + 1P) II

Types of prokaryotic viruses on the basis of composition of their genome and capsids; Genome organisation and replication of single stranded RNA and DNA and double stranded DNA phages of bacteria; Genetic control of gene expression by self and host coded products, phage-host interactions; Molecular genetics of lysogeny, immunity and phage variation; Transduction-general and site specific and its manipulation; secondary functions specified by phages; Genetic control of phage morphogenesis.

MBB.107 Molecular Genetics-5 (Plant Molecular Genetics) (3L) III

Plants as genetic system; General organisation of nuclear, mitochondrial and chloroplast genomes; Tissue specific expression of genes; Structure, organisation and regulation of nuclear genes concerning storage proteins, sugar and starch synthesis; Genes responding to hormones, phytochrome, abiotic and biotic stresses; plant-microbe interaction; Genes involved in photosythesis; Genetic interactions between nucleus, Chloroplast and mitochondria; Genetics of biogenesis and functioning of chloroplast and mitochondria; Mitochondrial control of fertility; Selectable markers in plants and their uses; Homeotic mutants in plants.

(Pre-requisite: MBB.101)

MBB.108 Plant Tissue Culture (2L + 2P) I

Cellular basis of life; Growth and differentiation of plants; Totipotency; Growth and morphogenesis in culture; Application of tissue culture for plant improvement, micropropagation, embryo rescue, anther culture, somaclonal variation, cellular mutagenesis, protoplast culture, somatic cell genetics, alien gene transfer; Cryopreservation; Secondary metabolites.

MBB.109 Plant Cell Biology (2L) I

General structure and constituents of plant cells; Similarities and distinctions between plant and animal cells; Cell wall, cell membrane, cell surface related functions; Endoplasmic reticulum, nuclear envelope, microbodies, golgiaprratus, tonoplast, vacuoles, their molecular structure, synthesis and function; Cyto-skeletal elements; Structure and function of major organelles; Chromosome, chloroplast, mitochondria, ribosomes in relation to cell growth and division; Specialized cells in various tissues; Regulation of cell cycle and cell division.

MBB.110 Biotechnology and Society (1L) III

Nature, diversity and organisation of life on planet earth; various mechanisms of generation of genetic diversity and their evolutionary implications; Developments about genetic technologies for gene isolation, synthesis and transplantation; Socioeconomic aspects of use of cloned genes in medicine, agriculture, industry and ecology; Safety procedures for avoiding hazards; Public policies in relation to advantages to society; Interaction between industry and science institutions; International cooperation; Horizons.

MBB.200/Bio.209/Gen.233 Protein Synthesis (3L + 1P) II

Genetic code; Structure and function of mRNA and tRNA; Ribosome structure and function; Organisation and regulation of ribosomal protein and r-RNA genes; Ribosome m-RNA interaction, colinearity protein biosynthesis in prokaryotes and eukaryotes, amino acid activation, polypeptide chain initiation, elongation and termination; Posttranslational modifications and their significance.

(Pre-requisite: MBB.211)

MBB.201/Bio.210/Gen.234 Gene Regulation (3L) III

General control of DNA, RNA, and protein synthesis; Gene regulation in prokaryotes; Gene clustering and operon concept; Mechanism of positive and negative control of gene expression; Translational and transcriptional control of regulatory mechanism of gene expression in eukaryotes; Role of posttranscriptional and post translational events in gene regulation; Isolation of repressor and characterisation of operator.

(Pre-requisite: MBB.100 & 200)

MBB.203/Bio.211 Biotechnology-1
(Genetic Engineering—Principles and Methods) (3L + 2P) I

DNA cloning strategies: cloning in yeast, *Escherichia coli* and *Bacillus subtilis*;

Characteristics of vectors derived from bacterial plasmids and phages and plant and animal viruses; Methods of nucleic acid and protein separation and sequencing; Restriction enzymes; Preparation and screening of genomic and cDNA libraries; Identification and isolation of structural genes and regulatory elements; Site directed mutagenesis; Transfer of cloned DNA and expression of cloned genes in foreign cells; Antisense RNA; Ribozymes; PCR.

(Pre-requisite: MBB.100, 201)

MBB.204 Biotechnology-2 (Industrial Biotechnology) (3L) III

Products of biotechnology and their living resources (organic acids, amino acids, peptides and proteins, enzymes, steroids and hormones, carbohydrates and glycocides, antibiotics, vaccines); Fermentational processes; Bioreactors; Enzyme-engineering, applications in human and animal food production (biomass, alcohols, mushroom; cheese and other dietary products, baked products); Microbial degradation of waste products; Agricultural and live stock production; Mineral recovery.

MBB.205 Biotechnology-3 (Plant Genetic Engineering) (2L + 2P) I

Methods of plant breeding in relation to the reproductive system; Comparison of strategies of crop improvement; Processing of genetically engineered variability for evolving superior genotypes; Methods of transfer and expression of cloned DNA into plant cells; Progress in molecular biology and genetic engineering of specific characters in specific plants (case studies), Transgenic plants; Application of genetic engineering in agriculture; Future prospects.

(Pre-requisite: MBB.108)

MBB.206 Molecular Biology of Photosynthesis and Nitrogen Fixation (3L) II

Chloroplast and mitochondrial genome; structure and function; Organisation and expression of the chloroplast proteins; Nuclear genes controlling chloroplast development; Molecular biology of light and dark reactions of photosynthesis; Molecular mechanisms of nitrogen fixation, genetics of nif genes, nodulin genes, nodule development.

MBB.207 Immunology (2L) II

Immune responsiveness in human and other animals; Chemistry and structure of immunoglobulins and their biological functions; Regulation of mammalian immunity, immunoglobulin genes during primary development of B and T cells; Aging; Autoimmune deficiency syndrome.

MBB.208 Recent Advances in Molecular Biology (2L) III

Recent advances in Molecular Biology of cancer, brain, cellular differentiation and morphogenesis etc. The teacher would be free to select topics of developments in Molecular Biology.

MBB.209 Monoclonal Antibodies—Principles and Practices **(1L) II**

Background theory, production, purification and processing, isotopic labelling; Uses (general and case studies), analysis by immune recognition of antigens, affinity chromatography, immunoflorescence; Generation of conventional antibodies; Special applications.

MBB.211/Bio.208/Gen.232 Nucleic Acids **(2L + 1P) I**

Biosynthesis of nitrogenous bases and nucleotides; Chemistry of nucleic acids; Structure and conformation of DNA and RNAs; DNA topoisomers, tRNA, mRNA and rRNA; Nucleases, endonucleases and related enzymes; DNA sequencing; Chemical synthesis of nucleotides and nucleic acids.

MBB.212/Bio.203 Enzymology **(3L + 1P) III**

Protein structure, conformation; Enzymes, classification, assay, isolation and characterisation; specificity, mechanism of action, transient and steady state kinetics, active site mapping, regulation of enzyme activity, multi enzyme complexes, enzymes and their application.

MBB.299 Seminar **1 credit (I, II, III)**

MBB.300/MPP.304 Molecular Biology of Plant Viruses **(2L + 1P) III**

Nomenclature and classification of viruses; variation, mutation and origin of viruses; virus strains and methods of their identification; use of monoclonal antibodies in identification of viruses and their strains; composition and structure of viruses; Molecular biology of viral genome replication, transcription, protein synthesis and maturation; Viral genome organisation and functions of viral proteins; Ultrastructural changes in the host; Cross protection; Production of genetically engineered resistant plants; Genetics of viruses; Viruses as vectors of information transfer; VLPs and cryptic viruses; Sub-viral pathogens.

Core Courses

M.Sc. MBB.100, 101, 108, 203 and 211.

Ph.D. MBB.100, 101, 108, 203, 204, 205 and 211.

XVI Mycology and Plant Pathology

Major Fields : Plant Virology
Plant Bacteriology
Mycology
Fungal Pathology

Minor Fields : A student majoring in one of the above major fields may take a minor in another field recognised as the major field in the discipline, but every student shall take not less than one minor (9 credits of course work) in another supporting major field from disciplines such as:

- Biochemistry
- Entomology
- Environmental Sciences
- Genetics
- Horticulture
- Microbiology
- Molecular Biology and Biotechnology
- Nematology
- Plant Physiology
- Soil Science and Agricultural Chemistry

DESCRIPTION OF COURSES

MPP.100 Introductory Mycology (2L + 2P) I

A comparative account of representative fungi belonging to Myxomycota and Eumycota; identification of fungi; introductory cytology, genetics and ecology; importance in agriculture, forestry, medicine and industry.

MPP.101 Introductory Virology (2L + 2P) I

Introductory; historical account and economic importance; theories regarding causes of virus diseases; symptomatology: external and internal symptoms; effect of environment on symptom picture; methods of transmission of plant viruses; insects in relation to plant viruses; physiology of virus-affected plants; movement of viruses in plants; general control measures and seed certification.

MPP.102 Introductory Bacteriology (2L + 2P) I

History and development; microscopy; stains and staining; methods of pure culture studies; classification and identification; morphology ultrastructure and chemical composition of surface layers; growth and nutrition; outline of bacterial metabolism; bacterial genetics and variability; serology; antibiotics and their mode of action; industrial production of penicillin; mycoplasma, PPLO, rickettsia, bacteriophages and bdellovibrios.

MPP.103 Plant Pathological Techniques (1L + 2P) I

Laboratory equipment and their use; preparation of selective culture media; pH adjustment; methods of inoculation and isolation, including single spore isolation of obligate and facultative parasites; maintenance and preservation of micro-organisms in pure culture; study of micro-organisms in pure culture; chromatography and spectrophotometry; collection of references and data for publication.

MPP.105 Non-parasitic and Phanerogamic Diseases of Plants (1L + 1P) III

Historical review; effect of air pollution; frost damage; diseases due to unfavourable temperature and soil moisture; nutritional deficiency disorders; methods of determining deficiencies in crops; diseases due to phanerogamic parasites.

MPP.201 Viral and Mycoplasmal Diseases of Plants (2L + 1P) III

Diseases of potato, tomato, tobacco, chilli, brinjal and cucurbits; diseases of graminaceous crops viz., sugarcane, maize, millets, rice and wheat; diseases of oilseed crops (sesamum, groundnut and brassica); diseases of citrus, banana, papaya, mulberry and temperate fruits; diseases of ornamentals and cash crops (large cardamom, cocoa, tea, coconut, sandalwood, etc.).

MPP.202 Virus-Vectors (2L) III

History of the development of vector science; the various groups and diseases transmitted by them with notable examples; structure and function of the mouthparts and mechanism of feeding of homopteran vectors alongwith brief coverage of salivary gland system and the alimentary canal; characteristics of non-persistent, semi-persistent and persistent types of vector-virus relationships; categorization of vector-borne viruses on the basis of route of transport (stylet-borne and circulative) and its limitations; ingestion-egestion hypothesis to explain non-circulative transmission by aphids; circulative and circulative propagative viruses/

disease agents and evidences of propagation; bimodal transmission; dependent transmission of circulative and nón-circulative viruses; effect of disease agents on the vector; nematodes and fungi; salient aspects of taxonomy and biology of aphids, leafhoppers land whiteflies; epidemiological aspect of the vector-borne diseases; management of vector-borne diseases.

MPP.203 Phytobacterial Diseases (2L + 1P) III

Historical developments; identification of bacterial diseases; taxonomy and problems of speciation in phytopathogenic bacteria; symptom types; general methods in the study of disease cycle and management of diseases; disease cycle in relation to seasons; host resistance: morphological, physiological and biochemical; environmental factors influencing disease development and epidemic build up; protection, cross protection and biological control; important diseases of field, vegetable, fibre and fruit crops.

MPP.204 Principles of Plant Pathology (2L + 1P) II

The nature and classification of plant diseases; mutual relationships between organisms; production, liberation and dissemination of inoculum; the phenomenon of infection, germination and entrance of the pathogen into the host; symptomatology: external and internal, including histopathology; growth and reproduction of pathogens; predisposition; the effect of environment and nutrition on disease development; epidemiology; mechanism of action of pathogens; physiologic specialisation; disease resistance; disease management.

MPP.205 Plant Disease Control (3L + 1P) II

History of plant quarantine, factors affecting efficacy of quarantine, introduction of foreign pathogens; cultural and handling practices as well as eradication of host and pathogen for control of diseases; systemic and non-systemic fungicides; soil disinfectants, antibiotics, bactericides, viricides and other chemo-therapeutants, compatibility of fungicides with agricultural chemicals; bioassay of pesticides, mode of action of fungicides/bactericides; treatment of seed, tuber, bulb and other plant parts for the control of disease; seed certification; equipments for pesticide application; host resistance and breeding disease resistant varieties; extension methodology for plant disease control.

MPP.206 Epidemiology, Forecasting and Assessment of Losses (2L) III

Factors governing epidemics; artificial and natural control of epidemics; prediction of epidemics, forecasting (warning) services, basic research for development of warning services; disease intensity and yield loss relationships; methods of estimation of losses.

MPP.207 History of Plant Pathology (1L) II

Phytopathology of ancient era, dark era, pre-modern era and modern era; development of sciences of plant bacteriology, plant virology and plant nematology; development of chemical control of plant diseases and early history of breeding for disease resistance; development of plant quarantines.

MPP.208 Seed Pathology (2L + 1P) I

Historical background; seed diseases; types of infection; disease transmission; methods of seed health testing; seed-borne diseases of fungal, bacterial and viral origin; seed health testing services; international cooperation in seed health testing and its implications; seed certification; post-harvest spoilage of seeds and grains; physical and chemical methods of control of seed-borne diseases.

MPP.209 Fungal Disease of Field Crops-I (2L + 1P) I

Rusts and smuts of wheat, barley, oat, rye, maize, sorghum and other millets; bunts of cereals; rusts of linseed, sunflower, safflower, castor and other crops; downy mildews of bajra, maize, wheat and other important crops.

MPP.210 Fungal Diseases of Field Crops-II (2L + 1P) II

Powdery mildews of cereals and other crops; ergots of rye, bajra, sorghum and other cereals; leaf spots caused by different fungi in cereals, oilseeds, pulse, fibre and other crops; root rots, foot rots, and wilts of important crops.

MPP.211 Fungal Diseases of Vegetable Crops (1L + 1P) I

Diseases of cucurbits, tomato, potato, brinjal, bhindi, cabbage, cauliflower, chillies, onions, garlic, sweet potato, carrot, beet root and spinach.

MPP.212 Fungal Diseases of Fruits and Ornamental Crops (2L + 1P) II

Diseases of fruits like apple, pear, peach, mango, citrus, guava, banana, papaya and grapes; and ornamentals like rose, gladiolus, chrysanthemum and carnation.

MPP.213 Fungal Diseases of Plantation, Spices and Medicinal Plants (2L + 1P) III

Diseases of tobacco, tea, coffee, rubber, coconut, arecanut, betelvine, turmeric, ginger, coriander, cumin fenugreek, fennel, cardamom, *Cinchona*, poppy, *Pyrethrum*, hemp, basak and other miscellaneous crops.

MPP.299 Seminar (1) I, II, III

MPP.300 Advanced Mycology (4L + 1P) II

Nomenclature, classification and evolution in fungi; ultrastructure; genetics, cytology, nutrition; hyper- and hypovirulence; fungal ecology; applied mycology.

(Pre-requisite: MPP.100)

MPP.301 Advanced Virology **(2L + 1P) II**

Nomenclature of plant viruses; virus-vector relationship; variation, mutation and origin of viruses and virus strains; properties of viruses, their shape, size and methods of determination; purification of plant viruses and properties of purified virus preparations; chemical composition and nature of viruses; serology and serological techniques in the study of plant viruses; inhibition of viruses; quantitative methods of assaying plant viruses; cross immunity; bacterial viruses; mycoplasmas as causal agents of plant diseases.

(Pre-requisite: MPP.201)

302 Advanced Bacteriology **(2L + 1P) II**

Nomenclature of bacteria; characterisation of various groups of bacteria; plasmid borne virulence and recombination; physiology of bacterial infected plants; mechanisms of crown gall formation, soft rots, wilts and leaf spots; bacterial exopolysaccharides, toxins and enzymes; infection process and factors affecting it; phages of phytopathogenic bacteria; transmission of bacteria through seeds and insects; general principles of disease control.

(Pre-requisite: MPP.102)

MPP.303 Physiological Plant Pathology **(2L + 1P) III**

Introduction; historical development; host pathogen interaction (fungi, bacteria, viruses and mycoplasmas); physiological changes in diseased plants; primary disease determinant, toxins; mechanism of resistance, gene deployment; phytoalexins; microbial interactions; antibiotics; fungal enzymes and their action.

(Pre-requisite: MPP.204)

MPP.304/MBB.300 Molecular Biology of Plant Viruses **(2L + 1P) III**

Nomenclature and classification of viruses; variation, mutation and origin of viruses; virus strains and methods of their identification; use of monoclonal antibodies in identification of viruses and their strains; composition and structure of viruses; molecular biology of viral genome replication, transcription, protein synthesis and maturation; viral genome organisation and functions of viral proteins; ultrastructural changes in the host; cross protection; production of genetically engineered resistant plants; genetics of viruses; viruses as vectors of information transfer; VLPs and cryptic viruses; sub viral pathogens.

Core Courses:

(A) For M.Sc.

(i) Within the discipline:	MPP.100, 101, 102 and 204
(ii) Outside the discipline:	Nil

(B) For Ph.D.

(i) Within the discipline:	MPP.100, 101, 102 and 204

MPP.300. (Majoring in Mycology)
MPP.301. (Majoring in Plant Virology)
MPP.302. (Majoring in Plant Bacteriology)
MPP.303. (Majoring in Fungal Pathology)

(ii) Outside the discipline: Nil

XVII Nematology

Major Field : Nematology

Minor Field : Every Ph.D. student shall take not less than two minors (9 credits of course work in each) and every M.Sc. student not less than one minor in disciplines such as:

Agricultural Statistics
Biochemistry
Entomology
Environmental Science
Genetics
Horticulture
Microbiology
Mycology and Plant Pathology
Plant Physiology
Soil Science and Agricultural Chemistry

DESCRIPTION OF COURSES

Nem.100 Introductory Nematology (2L + 2P) I

History of Nematology, economic importance of plant parasitic nematodes; characters of the phylum Nematoda, their taxonomic position and relationships to other organisms; dominance as a group, distribution etc., general morphology and biology of plant nematodes; important species infesting crops, the diseases caused and their control.

Nem.101 Nematological Techniques (2L + 2P) I

Methods of survey, collection of soil and plant samples; extraction of nematodes from soil using Baermann funnel, sieving techniques, Seinhorst's and Oostenbrink's elutriators, sedimentation techniques, centrifugal floatation etc., extraction from plant tissues using Baermann funnel, root incubation etc., floatation methods for cyst-forming nematodes; use and care of microscopes; counting and estimation of nematode population; methods of killing, fixing, preserving nematodes; preparation of temporary and permanent mounts for microscopic examination, whole mounts as well as parts of body; staining nematodes in plant tissues; raising nematode cultures; experimental techniques—pathogenicity, nematicidal screening, varieties for resistance etc.

Nem.102 Morphology of Nematodes (2L + 2P) I

A detailed account of the morphology, anatomy, histology and physiology of the body wall, digestive, excretory, nervous and reproductive systems; reproduction and development of nematodes including gametogenesis, embryonic development, hatching, moulting etc.

Nem.103 Plant Diseases caused by Migratory, Sedentary endoparasitic and allied nematodes (2L + 1P) II

Principles of pathogenicity, general symptomatology, history, morphology, taxonomy, distribution, economic importance, biology and control of Pratylenchus, Radopholus, Hirschmanniella, Meloidogyne, Nacobbus, Hypsopirine, Meloidodera, Heterodera, Globodera, Punctodera, Dolichodera, Sarisodera, Cactodera, Afrodera, Bellodera, Ephippiodera Thecavermiculatus.

Nem.104 Nematode Taxonomy-I (2L + 2P) I

Classification of nematodes (animal parasites, terrestrial, aquatic and plant parasitic forms) upto orders with emphasis on groups containing economically important genera; broader treatment of representative genera of such economically important groups.

Nem.105 Fundamentals of Nematode Taxonomy (2L + 2P) II

Definitions and terminologies relating to systematics, taxonomy, classification, identification. Theories of classification and species concepts. Variations. Taxonomic collections (Procurement, maintenance and procedures) and taxonomic publications. International Code of Zoological Nomenclature, its application and rules, General classification and diagnosis of groups containing soil and plant parasitic nematodes with emphasis on their relationships. Detail classification of plant parasitic nematodes up to generic rank; diagnosis, relationships and distribution of nematodes belonging to the orders Tylenchida (Super families—Tylenchoidea, Atylenchoidea, Hoploaimoidea, Heteroderoidea, Neotylenchoidea and sub-order Criconematina), Aphelenchida, Dorylaimida (Super families Longidoroidea and Trichodoroidea).

Nem.106 Plant Diseases Caused by Semi-endo, Ecto-Endo and Ecto-parasitic Nematodes (1L + 1P)

History, morphology, distribution, economic importance and biology of Rotylenchulus, Tylenchulus, Ditylenchus, Anguina, Aphelenchoides, Bursaphelenchus, Rhadinaphelenchus, Tylenchorhynchus, Longidorus, Trichodorus and Paratichodorous. Nematode vector-virus.

(Pre-requisite: Nem.103)

Nem.107 Fundamentals of Nematode Physiology (2L + 1P) I

An introduction to principles of nematode physiology: (a) Nutrition; (b) Digestion and Assimilation; (c) Pseudoceoelom and function of transport; (d) Physiology of Respiration; (e) Metabolism, (f) Excretion; (g) Physiology of muscles, nervous & sensory responses and behaviour and h). Physiology of growth, reproduction and development.

Nem.201 Advanced Techniques in Nematology (1L + 1P) II

Sampling techniques, Statistical designs, Instrumentation with principles. Electron microscopy-theory and practices; Electrophoresis; Colorimetery; Spectrophotometer, and GLC; Use of Radio-isotopes in Nematology. Cyto-genetics in relation to Nematology. Histochemistry. Tissue culture, computers for identification, and screening of resistant varieties. Bioassay techniques for nematicide screening; nematicidal residue analysis.

Nem.202 Nematode Ecology (3L + 1P) III

Definition and scope; components of environments, evolution of nematodes; ecological classification; dispersal, prevalence and distribution of nematodes; techniques of community analysis, soil as an environment for nematodes; effects of factors such as temperature, moisture, aeration, soil type, pH, organic matter etc. on nematode populations and their relations with plant; Relationships between nematode populations and plant growth models, population dynamics; ecological relationships between nematode and other organisms, ecological considerations in nematodes management; concepts of systems modelling in nematode-plant relations and nematode management.

Nem.203 Plant Nematode Relationships (2L + 1P) III

Parasitism in nematodes; origin of plant parasitism among nematodes; concepts of pathogenicity, proof of pathogenicity; host parasite relationships; types of parasitism and their modifications; injury to plants caused by various groups of plant parasitic nematodes, mechanisms involved in plant injury; histopathology of nematode-infected tissues; interaction of plant parasitic nematodes with other micro-organisms, fungi, bacteria and viruses; effect of environment in disease development and perpetuations; physiologic specialisation; host specificity; phenomenon of resistance in plants to nematodes, and mechanisms involved.

(Pre-requisite: Nem.100 or 103)

Nem.205 Nematode Management (2L + 1P) III

Concepts of nematode management in relation to crop loss and economics; Factors influencing nematode management; Principles involved in different methods of control along with advantages and limitations; Integrated nematode management; Management in terms of advisory work.

Nem.206 Disease Complexes Caused by Nematodes and other Pathogens (2L + 1P) I

Association of nematodes with other micro-organisms; detailed account of disease complexes involving nematodes and bacteria, nematodes and fungi, nematodes and viruses, nematodes and nematodes.

(Pre requisite: Nem.103)

Nem.299 Seminar (1) I/II/III

Nem.300 Advanced Nematode Physiology (3L) II

Chemical composition of nematode; Concepts regarding host finding mechanism; Hydrolytic enzymes and their role; Biochemistry of intermediary metabolism; Dynamics of permeation; Nitrogenous excretion; Physiology of hatching and hatching factor; Physiology of survival mechanism; Physiological effect of biologically active compound. Physiology and biochemistry of certain aspects of plant nematode relationship.

Nem.301 Nematode Taxonomy-II (2L + 3P) III

Comparative study of morphological variation and evaluation of characters in the classification of plant parasitic nematodes; detailed study of nematode taxonomy upto genera and important species with special reference to plant parasitic nematodes and important genera of other soil inhabiting forms; identification of nematodes with the help of keys and descriptions; preparation of keys for identification of species etc.

(Pre-requisite: Nem. 104 & 201)

Core Courses:

(A) For M.Sc.

(1) Within the discipline: Nem.100, 101, 102, 103 and 105 (19 Cr.)

(2) Outside the discipline: Nil

(B) For Ph.D.

(1) Within the discipline: Nem.100, 101, 102, 103, 105, 202 and 205 (25 Cr.)

(2) Outside the discipline: As.120 or As.121.

XVIII Plant Physiology

Major Field :	Plant Physiology
Minor Field :	Every Ph.D. student shall take not less than two minors (9 credits of course work in each) and every M.Sc. student not less than one minor in discipline such as:

Agricultural Physics
Agronomy
Biochemistry/Molecular biology & Biotechnology
Entomology
Environmental Science
Genetics
Horticulture
Microbiology
Mycology and Plant Pathology
Soil Science and Agricultural Chemistry

DESCRIPTION OF COURSES

PP.100 Principles of Plant Physiology-I (3L) I

Structure of a typical cell, cell wall and plasma membranes, nucleus and nuclear membrane, ribosomes, glyoxsyomes, peroxisomes and golgi apparatus. Diffusion, imbibition, osmosis, osmotic quantities and their inter-relationships, plasmolysis, forces involved in water absorption by root cells, movement of water within the plant, ascent of sap. Transpiration: Water loss from plant parts, stomatal movement—opening and closing mechanism, evapotranspiration soil-water-plant relationship, water use efficiency, water stress: kinds of stress, escape and tolerance mechanisms. Soil as the source of nutrients, nutrient uptake by plant roots, passive and active uptake, Donan's equilibrium, apparent free space, carrier concept of ion uptake. Essential elements: specific role in plant functions, deficiency and toxicity symptoms. Significance and historical background of photosynthetic apparatus and pigments-structure and function, light absorption and transfer of energy, electron transport and photophosphorylation-cyclic and non-cyclic, carbondioxide fixation and reduction; C_3 photosynthetic cycle-outline of reactions, regulation and location, C_4 photosynthetic cycle and crassulacean acid metabolism-main features and evolutionary significance, factors affecting photosynthesis, CO_2 compensation concentration, photosynthesis in relation to herbicides. Respiration: Definition, significance, glycolysis and fermentation, Kreb cycle, location and outline of reactions, factors affecting respiration, respiratory nutrient, Pasteur effect. Photorespiration: Location, outline of reactions, significance in plant productivity. Carbohydrate metabolism: Translocation and interconversion of sugars, mechanism of sugar transport, starch-structure synthesis and degradation. Fat metabolism: Synthesis of lipids. Nitrogen metabolism: Nitrogen cycle and its fixation by symbiotic and free living bacteria, nodulation, NO_{-3} and H_{-4} assimilation in plants, amino acids: synthesis and transamination, protein structure and synthesis. Definitions, course of growth and its measurement, natural plant hormones—their physiological effects. Photoperiodism: Definition and perception of photoperiodic stimulus, evocation, phytochrome, circardian rhythms, flowering hormone, vernalization, senescence, plant movements.

PP.101 Experimental Plant Physiology-I (2P) I

Measurement of osmotic potential by incipient plasmoytic method, water potential by weight method. Use of psychrometer for measurement of water potential and osmotic potential. Demonstration of pressure chamber method for water potential measurement. Measurement of transpiration. Measurement of photosynthesis by infra red gas analyser. isolation and separation of photosynthetic pigments. Determination of stomatal index of leaf. Bioassay of plant growth regulators (gibberellin and auxin). Determination of nitrogen, phosphorus and potassium in plant material-obtained from plants supplied with sufficient and deficient nutrients (N, P, K).

PP.199 Pro-Seminar (1)

PP.200 Principles of Plant Physiology-II (a) (3L) II

Cellular structure and function, enzymes, fermentation and respiration, energetics of respiration and biological synthesis, photosynthesis, nitrogen metabolism.

PP.201 Principles of Plant Physiology-II (b) (3L) III

Osmotic relation of plant cell, uptake of solute, water relation of the whole plant, growth at cellular level and of the whole plant, flowering.

PP.202 Experimental Plant Physiology-II (2P) II

Determination of soil-moisture constants, growth regulator, vernalization and photoperiodism, enzyme activity, reproduction of symptoms due to micro-nutrient deficiencies.

Course 'PP 100' is a pre-requisite for M.Sc. students who want to take advance course.

PP.250 Stress Physiology **(2L + 1P) I**

Problems of water, temperature, salt water logging and pollution stresses, internationally and nationally. Drought: Magnitude, frequency and severity. Impact on agriculture and society. Response of wild populations and crops to drought. Drought resistance in crops: various mechanisms of some case studies. Molecular and genetic basis of drought resistance. Breeding for drought resistance. Sal: stress: Alkalinity and salinity, morphological, physiological and biochemical responses to various salt. Mechanism of resistance to salt, and selection through tissue culture. Breeding for salt resistance. Temperature and crop productivity. Tolerance to heat and frost. Growth, metabolic processes and tolerance to water logging. Pollution and crop productivity. Pollution indicators. Genetic engineering for various stresses.

PP.251 Mineral Nutrition **(3L + 1P) II**

History, definition and classification, mineral content of plant tissues. Pathway of nutrients from external solution into the roots. Structure and composition of membranes. Driving forces for the transport of nutrients across the membrane. Characteristics of ion uptake by the roots. Interaction between the ions, radial transport across the roots, ion uptake along the roots, mechanisms of ion release into the xylem, xylem transport, phloem transport, nutrient cycling between shoots and roots, remobilization of mineral nutrients. Uptake of gases through stomata, uptake of solutes, foliar application of mineral nutrients, leaching of mineral elements from leaves. Availability in soil/atmosphere and crop requirements, uptake and translocation, metabolic functions, optimum requirement, deficiency and toxicity, visible morphological and anatomical effects, cellular and sub-cellular effects, effect on composition and metabolism. Nutrient release and immobilization, nitrification and denitrification, growth and morphology of roots, nutrient uptake process, allelopathy, major nutritional variation, inefficiency in nutrient utilisation, efficiency under nutrient stress, mechanism of differences in nutrient requirements, screening and selection techniques. Practicals: Diagnosis by visible symptoms, plant analysis, histochemical and biochemical methods, plant analysis vs. soil analysis, treatment of disorders.

PP.252 Physiology of Reproduction **(2L + 1P) I**

Photoperiodism, histology, morphology and endogenous control of floral initiation, measurement of flower initiation, photoperiodic response types, photoinduction and photoperception, florigen and induced state, biochemistry of flowering, kinetics of photoinduction, floral evocation, phytochrome, measurement of time, vernalization, sex expression, miscellaneous effects of daylength and its implications in agriculture and horticulture.

PP.253 Photobiology **(2L) II**

Photomorphogenesis, phototropism, utilisation of light energy in photosynthesis, effect of long and short-wave irradiation on growth, physiological basis of radiation sensitivity.

PP.254 Physiology of Growth and Yield (2L) II

Natural resources in productivity of plants, principles of growth analysis, definition of crop plants and yield components in different crops, patterns of growth, factors affecting growth-plant architecture, radiation, temperature, CO_2 Dry matter partitioning, crop simulation.

PP.255 Chemical Regulation of Growth (2L) III

Plant growth regulation: Basic concepts, brief history, discovery and isolation of auxins, gibberellins, cytokinins, abscisic acid and ethylene-their biosynthesis. Mode of action of plant hormones: genetic basis of cellular differentiation- sites of control of gene expression. Physiological interaction effects of plant hormones in regulation of apical dominance, parthenocarpy and fruitset, fruit growth and ripening, senescence, flowering, seed and bud dormancy and abscission. Growth retardants as plant growth regulators: Physiological effects, inhibitors in sterol biosynthetic pathway, mode of action. Hormones and source sink relationship. Hormonal regulation of plant behaviour: Applied research, tissue culture, biosynthetic pathways as control points in hormone regulated development, plant hormone reception, regulation of development by non-hormone messages. Role of plant growth regulation in agriculture-A case study for analysing the role of PGRs in enhancing productivity and in post-harvest physiology. Hormone and enzyme regulation.

PP.256 Physiology of Crop Plants (2L) III

Origin, evolution and distribution of crops, crop adaptability to different agro-climatic conditions. Physiological processes governing productivity, influence of crop climatological factors. Case histories of some important crops e.g. wheat, rice, legumenous and oilseed crops.

PP.257 Photosynthesis and Chemosynthesis (2L) I

Historical, primary processes in photosynthesis: Energy transfer, flourescence, chloroplast structure and function, pigment-protein complexes, photosynthesis, electron transport, biogenesis and molecular genetics of chloroplast, ATP synthesis, oxygen evolution. Carbon fixation, evidences for carbon fixation cycles, metabolism of carbon, carbon compounds, photoregulation of enzymes of carbon fixation. Photorespiration and RUBP carboxylase/oxygenase. Crassulacean Acid metabolism, translocation of photosynthates, environmental regulation of photosynthesis, predicting photosynthesis, canopy photosynthesis, genetics and evolution of photosynthesis.

PP.258 Cell Physiology (2L) II

Ultrastructure of plant cell organelles, biosynthesis and degradation of nucleic acids and nucleoproteins, biosynthesis of proteins and polysaccharides.

PP.259 Advanced Methods in Plant Physiology (2P) III

Ion-uptake by adopting ratio-tractor techniques, analysis of micro-elements, enzyme reaction (spectrometry and scintillation counter techniques).

PP.260 Phytotronics **(2L) II**

Concept of a Phytotron: need of control environment for plant growth and development: Important phytotrons around the world, growth cabinet v/s. controlled glass house. Manipulation of light intensity, quality and duration, manipulation of temperature combination, maintenance of humidity and gases, operational aspects of phytotrons, use of phytotrons for physiological, biochemical, plant microorganism interaction, nutritional and crop improvement problems.

PP.261 Physiology of Seeds **(2L) III**

Introduction, seed structure and function, importance of seeds. Chemical composition of seeds, seed development and maturation, physiological and biochemical changes, environmental influences, pathways of interconversions, seed germination, factors influencing including phytochrome, breakdown (mobilization) of stored products: carbohydrates, fat, protein, control processes in the mobilization of food reserves, hormonal aspects of germination, seed dormancy: defined types mechanism and method for breaking seed dormancy, seed storage and packaging need for storing seed, types of seeds (orthodox and recalcitrant) factors influencing loss of seed viability during storage, physiological and biochemical changes associated with seed ageing, theories of seed ageing, conservation of germplasm: cryopreservation, *in vitro* techniques in germplasm conservation, gene libraries, seed packaging: need materials and methods, seed storage structures: protection from water, temperature contaminants etc. controlled atmosphere, seed vigour: concept, importance, measurement, invigoration, quick viability test, initial viability, field emergence and yield, seed hardening.

PP.262 Plant Metabolism **(3L) II**

Biosynthesis and degradation of hexose phosphate, biosynthesis of sucrose and its utilisation, translocation, breakdown and storage, respiratory metabolism, glycolate pathway, pentose phosphate pathway, localization and evidence for its operation. Starch synthesis, accumulation and breakdown during germination and in leaves, regulation of starch metabolism enzymes of cell wall synthesis cellulease, organic acids synthesis and its regulation, crassulacean acid metabolism and its regulation, factors affecting CAM metabolism. Synthesis of long chain saturated and unsaturated fatty acids, plant fatty acids, glyoxylate cycle, membrane lipid structure and function, phospholipids, sulfolipids, galactolipids, synthesis of fat during germination and seed development. Nitrogen cycle, fixation nitrification and denitrification, nitrate and ammonia assimilation, transamination, amino acid synthesis, non-protein amino acids synthesis, nitrogen redistribution in cell, nitrogen interconversion and transport during plant development, nodule metabolism, protein synthesis and its metabolism. Biosynthesis and breakdown of nucleic acid and nuclei protein, synthesis and role of vitamins, sulphur metabolism and phytotoxins.

PP.299 Seminar **(1)**

Core Courses:

(A) for M.Sc.: PP.200, 201 and 202 (9 Cr.)

(B) for Ph.D.: PP.251, 256 and 259 (8 Cr.)

XIX Seed Science and Technology

Major Field : Seed Science & Technology

Minor Field : Every M.Sc. student will take one minor in the discipline such as:

- Agricultural Economics
- Agricultural Engineering
- Agronomy
- Biochemistry
- Entomology
- Environmental Science
- Genetics
- Horticulture
- Plant Physiology
- Mycology & Plant Pathology

DESCRIPTION OF COURSES

ST.100 Seed Development and Morphology (2L + 1P) I

Introduction, origin and evaluation of seed; seed development in cultivated plants; micro and megasporogenesis; embryogenesis; apomixis and seed coat structure; seed identification and seedling morphology.

ST.111/Gen.111 Seed Production, Principles and Practices (2L + 2P) III

Theory: Seed as a basic input in agriculture; quality concept in seed production; classification of crop plants in relation to mode of reproduction; flowering in crop plants, its modification for hybrid seed production; seed setting, its improvement in insect pollinated plants by bees etc; effect of environment before harvest on seed quality; genetic purity, its concept and importance in seed production; life span of varieties and factors responsible for their deterioration and shift in their genetic make up; prevalence of natural crossings in crops plants; isolation requirements for seed production; steps in the breeding, release and multiplication of varieties, composites and hybrids; seed quality control system and organisations; seed certification, its philosophy, purpose and procedure; seed act, its provisions, rules and regulations; suitable seed production areas; the concept of "seed village", seed production procedures in cereals, millets, pulses, fibre and forage crops, oilseeds and vegetables; agencies responsible for seed production, seed industry in India.

Practicals: Practical field work on the seed production practices of different crops with particular reference to maize, jowar, bajra, cotton, pulses and vegetable crops; study of morphological and seed characters featuring in varietal description of important crops; filling forms of seed growing contracts; field inspection of different seed crops at various stages of growth; record keeping; visit to quality control laboratories and seed production fields.

ST.140 Seed Testing (1L + 1P) II

Seed testing with special reference to India, sampling, mixing and dividing, purity analysis-principles and procedures; germination test and its application, quick viability test; moisture determination, testing for trueness to variety; use of tolerance test in seed testing, seed sample storage, seed health tests, issue of certificate and reports conducting seed surveys.

ST.141 Seed Storage, Physiology, Vigour and Viability (2L + 1P) II

Introduction, need for seed storage, stages of seed storage, factors influencing seed storage, physiological, biochemical and cytological changes in seeds during storage, causes of seed deterioration, prediction of seed storability, storage of certified, foundation, breeder seed and germplasm, seed packaging, construction and equipping seed stores, cryopreservation, seed vigour and its concept, seed priming, physiological and biochemical basis of priming, seed vigour, viability and yield.

(Pre-requisite: PP.100)

ST.142 Seed Pathology-II (2L + 1P) II

History and economic importance of seed pathology in seed industry, methods of examination of seed borne organisms, taxonomic aspects of fungi occurring in seeds, their identification and estimation in the seed samples, mechanisms of transmission of seed borne micro organisms and relationship between seed borne infections and expression of disease in the field, pathology of stored seeds, Identification of seed borne bacteria and viruses and their transmission, role of micro organisms in seed quality deterioration and germination, control of seed borne diseases by different methods.

(Pre-requisite: MPP.104)

ST.143/AE.143(s) Seed Processing (2L + 1P) III

Introduction of seed processing, preparing seed for processing, seed drying; cleaning and grading, seed treatment, seed handling, weighing and bagging, seed storage, construction, layout and installation of seed processing plant, economics of seed processing and the management of seed processing plants.

ST.200 Seed Production and Certification of Rabi Field Crops (1L + 1P) II

Production and certification of different classes of important rabi cereals, pulses, oilseeds, forage crops and potato with special emphasis on land requirement, rogueing, field inspection, harvesting, threshing, pre-processing care, sealing, bagging and issue of certificates.

ST.201 Seed Production and Certification of Kharif Field Crops (2L + 2P) II

Production and certification of different classes of seed of important kharif cereals, millets, pulses, oilseeds, fibres, forage and other miscellaneous crops with special emphasis on land requirement, isolation, critical cultural practices, pollination management, rogueing, field inspection, harvesting, threshing, pre-processing care, sealing and bagging and issue of certificates.

ST.203 Testing for Genuineness of Cultivars (1L + 2P) II

Object of cultivar purity test, general principles and methods. Use and limitation of laboratory, green house and field plot methods in determination of genuineness of cultivars, recent advances in conducting genetic purity tests in laboratory, green house and field plot tests in tropical crops, a case study in hybrid cotton, reporting of results and inference.

ST.211/Ent.211 Seed Entomology (1L + 1P) III

Seed losses in storage; insects associated with seeds of cereals and pulses; germ eating insects; insects of vegetables seeds, different aspects of seed treatment; packaging and storage of seeds; methods of storage of seeds in coastal and north eastern zones, different aspects of seed fumigation, preservation of seeds on longer term basis, seeds and seed health law, compatibility of fungicides/insecticides used in different seed treatment, causes for losses in germination of seeds damaged by insect, role of insect, pollinators in seed production and quarantine laws.

(Pre-requisite: Ent.111)

ST.243/Hort.243 Principles and Techniques of Vegetable Seed Production (4L + 1P) II (Even Years)

Seed morphology and development in vegetable seeds; raising of crops for vegetable seed production, environmental factors related to flowering/bolting in vegetable crops, pollination systems and breeding techniques related to vegetable production in different crops, isolation distances, rogueing, selection procedures and criteria for seed production, hybrid seeds.

ST.261/PP.261 Physiology of Seeds **(2L) III**

Seed structure and chemical composition; development and maturation, germination, breakdown of storage products, endogenous hormonal regulation, effect of stimulators and inhibitors; dormancy, its causes and breakage, specific problems of seeds of crop plants.

(Pre-requisite: PP.100)

ST.299 Seminar **(1L)**

Core Courses

(a) Within the discipline:

ST.100, ST.140, ST.111/Gen.111, ST.211/Ent.211

(Pre-requisite to be taken wherever necessary)

(b) Outside the discipline:

Gen.100, MPP.106, PP.100.

XX Soil Science and Agricultural Chemistry

Major Field :	Soil Science Agricultural Chemistry (For M.Sc. students: Soil Science & Agricultural Chemistry)
Minor Field :	A student majoring in one of the above fields may take a minor in the other field recognised as a major in the discipline, but every student shall take not less than one minor (9 credits of course work) in another supporting major field from the following disciplines:

Agricultural Physics
Agricultural Statistics
Agronomy
Entomology
Environmental Science
Genetics
Horticulture
Microbiology
Mycology and Plant Pathology
Plant Physiology

DESCRIPTION OF COURSES

*RC.4 Introductory Soil Science (3L) I

Nature and origin of soil; soil formation; composition of soil; soil organic matter and organisms; properties of soil; soil fertility; soil acidity, salinity and alkalinity; soil water plant relationships; manures, fertilisers and soil amendments; soil and water conservation; soil classification; soils of India.

SSAC.100 Fundamentals of Soil Science **(3L + 1P) I**

Soil-their origin, morphology and nature; classification of soil materials; rock forming minerals; weathering and soil formation; factors and processes of soil formation; composition of soils; physical physico-chemical, biological and minerological properties; soil air, water temperature; soil organic matter; soil organisms and their activities: nutrients present in the soil; management of saline, alkali and acid soil; soil fertility status; sources, characteristics and application of manures, fertilisers, soil amendments and soil conditioners; principles of soil classification and land utilisation; soils of India.

SSAC.102 Quantitative Analytical Chemistry **(2L + 2P) I**

Ionic equilibria; ionic product, hydrolysis, hydrogen ion concentration, solubility product; methods of quantitative analysis and separations; formation and properties of precipitates; co-precipitation and fractional precipitation; volumetric analysis; classification and theories of reactions; theory of indicators; instrumental methods of analysis; organic reagents in inorganic analysis.

SSAC.103 Physical Chemistry **(3L + 2P) I**

States of matter; kinetic theory of gases; first, second and third laws of thermodynamics; thermodynamic functions; free energy concept; Phase Rule; chemical equilibrium; equilibrium constant, homogeneous equilibrium; surface tension and surface energy; viscosity of liquids; dipole moments; osmosis and osmotic pressure; surface phenomena, adsorption; colloids, electrical properties of surfaces; electrolytic conduction, the E.M.F.'s of cells, electrode potentials; activity coefficient; acids, bases and electrolysis; potentiometric and conductometric titrations.

SSAC.104 Organic Chemistry **(4L + 1P) I**

Classification and nomenclature; characterisation of organic compounds; modern interpretation of covalency and theory of molecular orbitals; chemistry of aliphatic, alicyclic, aromatic and heterocyclic compounds; isolation of plant products; chemistry of essential oils, terpenoids, alkaloids, lipids, proteins, carbohydrates and plant pigments.

SSAC.106 Soil Geology **(2L + 1P) I**

Scope of geology in soil studies; relationship between geology and soil; rock forming minerals—their classification and composition; important diagnostic rocks—classification, composition and characteristics; weathering of rocks and rock minerals; weathering stability, sequences and indices of minerals; chemical weathering-factors and stages; weathering and release of nutrients; principles of geomorphology; fundamental concepts of geomorphic processes; geological formations of India.

SSAC.107/AP.130 Fundamentals of Soil Physics (Soil Physics-I) **(3L + 1P) II**

Scope of soil physics; soil as a disperse system; mechanical composition of soils; soil structure—classification, genesis, evaluation and agricultural significance; soil compaction; soil crusting; soil water retention, movement of water under saturated and unsaturated conditions; infiltration; redistribution; evaporation of water and its control, soil water balance; soil aeration and its characterisation; thermal regime of soil; soil consistency, plasticity, shear strength and soil tilth; physical properties of soil in relation to erosion and run-off; use of isotopes and radiations in soil physics investigations.

SSAC.108 Soil Genesis and Classification (2L + 1P) II

Historical development of soil genesis; fundamental concepts of soil genesis; weathering and soil formation; factors of soil formation; parent materials and soils of India; Major soils of the world; micromorphology, techniques and pedological features, systems of soil classifications; soil taxonomy; nomenclature, categories of the soil orders, sub orders and great groups; importance of soil family for the user agencies; interpretation of soil data for classification; benchmark soils of India; importance of soil temperature and soil moisture regimes; description of type-pedon.

(Pre-requisite: SSAC.100)

SSAC.109 Manures and Fertilisers (3L + 1P) III

Role of manures and fertilisers in crop production; rural compost—sources, preparation, losses of nutrients and methods of conservation; aerobic and anaerobic decomposition; C/N ratio; utilisation of sewage, sludge; effluent and activation of sludge; production of combustible gas from organic wastes; urban compost, sources and methods of preparation; mechanical composting; factors affecting composting operations; concentrated organic manures-processing and enrichment of organic wastes to make manures; green manuring; production, characteristics and use of various forms of nitrogenous, phosphatic and potassic fertilisers; complex fertilisers; fertiliser mixtures; granulation of fertilisers; use of nitrification retarders; slow acting fertilisers; liquid fertilisers; polyphosphates; anhydrous ammonia and ammonia solutions; time and methods of fertiliser application; foliar fertilisation; fertiliser practices in relation to soil; use of secondary elements and micronutrients; evaluation of manures and fertilisers.

SSAC.110 Soil Survey, Soil Mapping and Cartography (2L + 1P) I

Soil and landscape-soil as three dimensional landscape; purpose of soil survey; kinds of soil surveys—reconnaissance and detailed; generalised soil maps and schematic soil maps; soil survey work plan; base maps; aerial photographs and mosaics; planimetric and topographic maps; conventional symbols; examination and description of soils in the field; identification and nomenclature of soil horizons; preparation of legends and plotting soil boundaries in the field; soil classification; soil correlation; interpretive groupings of soils for land use planning; soil survey report; soil management practices; soil productivity ratings; soil maps and reports.

(Pre-requisite: SSAC.108)

SSAC.150 Analysis of Soil, Plant and Water (1L + 4P) II

Errors of observation and sampling; sampling procedures for soil plant and water; redox, metal and hydrogen ion indicators; principles of volumetric and gravimetric analysis; complexometric reaction; absorptiometric and flame emission methods; pH and conductivity measurements; quality rating of irrigation water; total elemental analysis of soils; ashing, digestion and analysis of plant samples; water analysis.

SSAC.151 Soil Testing and Fertilizer Recommendation (1L + 3P) III

Soil Testing—its scope, importance and uses, historical background and development of soil testing in India; soil sampling; soil test methodology—concepts and principles; soil tests summaries and preparation of regional soil fertility map; organisation and operation of soil testing laboratories and soil test equipment.

SSAC.152 Radiotracer Techniques (2L + 2P) I

Background for the use of radioisotopes and radiations in agriculture; nuclear reactions; radioactive elements as indicators or tracers; radio activity—discovery, nature and properties of radiations, fundamental decay law, units for radioactivity; artificial radioactivity; principles of tracer methodology and basic difficulties; labelling; concept of specific activity and isotope dilution principle; tracer kinetics; principles and methods for detection and measurement of radiation; procedures for radioassay; radioautography, statistics of counting; nuclear instrumentation techniques; liquid scintillation counting; mass spectrometry; radiation hazards and safety procedures; radiation dosimetry and waste disposal; use of isotopic techniques in agriculture; radioactivation and radiometric analysis.

SSAC.153 Physical Chemistry of Soils (4L + 2P) II

Goldschmidt's laws of crystal chemistry; principal silicate structures; physical chemistry of weathering of minerals; nature and properties of organic and inorganic constituents of soils; activity of ions in soil systems; ion exchange and fixation; formation and properties of acid, alkaline, saline and sodic soils; oxidation and reduction phenomena in soils.

(Pre-requisite: SSAC.103)

SSAC.155 Soil Biology in Relation to Soil Fertility and Pedogenesis (3L + 1P) II

Soil as a biological habitat; distribution and types of soil organisms and their significance in soil formation, aggregation and soil fertility; organic matter in soil; soil enzymes and their significance; biological equilibrium in soil.

SSAC.156 Water Quality for Irrigation (2L + 1P) III

Geochemistry of water, chemical composition of water from different sources, nature and significance of dissolved constituents in water; interactions of ionic constituents in water with soil; chemical and physical properties of irrigated soils; hydrodynamic dispersion phenomenon during leaching, transport of salts through soils; water quality rating for irrigation including soil and plant factors; salt tolerance of plants; industrial and sewage water composition and its use for irrigation.

SSAC.158 Chemistry of Problem Soils and their Reclamation (3L + 1P) III

Scope, introduction and concepts of problem soils; extent and distribution of problem soils in India; chemical principles involved in genesis and development of problem of soils such as acid, acid sulphate, saline, saline-sodic, calcareous and waterlogged soils, wastelands, other degraded soils etc.; thermodynamics of soil solution (described in terms of activity concept, equilibrium constant, ionic association etc.); laws of cation exchange as applied to affected soils including solute transport; clay mineralogy and mineralogical transformations in salt affected soils including acid sulphate soils; chemical, physical and biological properties i.e., dispersion, permeability, swelling, precipitation and dissolution of lime and other soil constituents; water quality criteria; nature of soil acidity and chemical equilibria operating in acid and acid sulphate soils; usefulness of pH-Eh diagrams and 'pe + pH' concepts in handling redox equilibria; chemistry of paddy soils such as electrochemical changes, minerale, equilibria, ion exchange and chemical kinetics etc.

Diagnostic criteria for salt-affected soils, wastelands, acid soils and soil related constraints in problem soils; chemistry of reclamation of problem soils by various amendments; advances in technology for reclamation of problem soils including soil-plant adjustment principles with particular relevance to Indian conditions; technology transfer for problem soils.

SSAC.199 Pro-Seminar (1)

SSAC.201 Soil Clays and Clay Minerals (3L + 1P) III

Structure of clay minerals; identification and quantification of soil clay minerals; non-crystalline clays; genesis and transformation of clay minerals; clay-organic complexes; surface chemistry of clay minerals.

(Pre-requisite: SSAC.153)

SSAC.206 Soil Chemistry and Plant Growth (3L + 2P) II

Essential nutrients for plant growth; nutrient requirements of crops; soil colloids and productivity; chemistry of soil organic matter; fixation and release of ions; mechanisms of ion absorption and uptake; soil solution; movement of ions from soil to plant root; cation exchange capacity of plant roots; factors affecting nutrient absorption; nutrient mobility; adverse soil conditions; soil acidity and liming; acid sulphate soils, soil salinity and alkalinity; chemistry of water-logged soils; toxic substances in soils; transformation of nutrient elements in soil-crop system; methods for assessment of soil fertility; soil tests and significance of nutrient fractions, concept of critical level, targetted yield and multiple regression techniques in soil test-crop response relationship; nutrient utilisation efficiency; chelation, coating and organic matter in relation to nutrient availability; crop growth and nutrient relations.

(Pre-requisite: SSAC.100 and 103)

SSAC.207 Instrumental Methods of Analysis **(2L + 1P) III**

Basic electronics for instrumentation; theory and application of chromatographic and ultra-violet, infra-red, NMR, mass spectrometry, flame emission and atomic absorption spectroscopic methods; electrometric techniques; elements of radioassay.

SSAC.208 Fertiliser Technology and Usage **(3L + 1P)**

Fertiliser production, consumption and agricultural production in India—future projections; chemistry, technology and use of ammonia and its derivatives; regulation of nitrogen supply to crops; chemistry, technology and use of phosphatic and potassic fertilisers; advances in secondary and micronutrient fertilisation; technology and use of complex fertilisers; liquid and suspension fertilisers; factors influencing fertiliser use efficiency; fertiliser use in problem soils; long term effects of fertilisers; evaluation of relative efficiency of fertilisers; Fertiliser quality control; effect of fertiliser production and use of environmental pollution.

SSAC.209 Advanced Soil Clay Mineralogy **(3L + 1P) III**

Detailed structure analysis and present status of structure of clay minerals; nomenclature and systems of classification; layer-charge relations among the clay minerals; structure, alteration and weathering of rock minerals; genesis and properties of soil clay minerals; weathering sequence of clay size minerals and frequency distribution; origin and properties of amorphous minerals in soil; methods of study of clay minerals; quantitative mineralogical analysis; quantitative clay mineral analysis of soil.

(Pre-requisite: SSAC.153)

SSAC.299 Seminar **(1)**

Core Courses

(A) For M.Sc.: SSAC.102, 103, 107, 108, 109 and 153 (26 Cr.)

(B) For Ph.D.: SSAC.206 (5 Cr.)

XXI Course on Introductory Agriculture

(FOR NON-AGRICULTURAL STUDENTS)

A.1 Principles and Practices of Crop Production (2L + 2P) I

Important crops of India—their area and distribution; crops in relation to climate, agro-climatic zones; cropping systems, multiple cropping, intercropping: water relations of plants, principles and practices of irrigation: moisture conservation in dryland agriculture: tillage in agriculture: manures & fertilizers and their efficient use: crop rotation in relation to soil fertility management; weeds and their control.

Area, distribution, production and agronomy of field crops: Cereals—rice, wheat, maize, sorghum, and millets. Pulses—chickpea, pigeonpea, mungbean, lentil, blackgrams. Oilseeds—groundnut, mustard, soybean, sunflower. Cash crops—Sugarcane, cotton, potato, and Fodder Crops—berseem, oats.

A.2 Principles and Practices of Horticulture crops (2L + 2P) I

Layout and establishment of orchards and kitchen and flower gardens, growing plants in pots, vegetable growing, climatic, soil and cultural requirements of major horticultural crops, crop rotation, application of manures and fertilizers and weed control, methods of propagation and seed production, harvesting and storage, causes of spoilage of processed fruits and vegetables and their management, principal methods of preservation.

A.3 Soils and Agriculture (2L + 1P) I

Soil as a natural resource; composition of soils; climate and soil; soil physical environment and plant growth; soil physico-chemical and chemical environment and plant growth; essential plant nutrients-functions and deficiency symptoms; soil sampling; soil test methodology; soil testing and fertilizer recommendations for important crops; follow-up trials on farmers fields; major soils of India in relation to crops and cropping systems; role of manures and fertilizers in crop production; characteristics and use of different nitrogenous, phosphatic and potassic fertilizers; problem soils and their reclamation; soil erosion and its control; soil and water conservation.

A.4 Insect/mites/nematode pests of Agricultural Importance and their management (1L + 2P) I

Insects, mites and nematodes-their identification, classification and importance in agriculture, nomenclature, distribution; biology and bionomics of major pests of cereals and millets, tuber crops, fibre crops, sugarcane, oilseeds, pulses, vegetables, fruits and stored grains; Principles of pest control; Introduction to insecticides, miticides, nematicides and their appliances

A.5 Elements of Cytogenetics and Plant Breeding (1L + 1P) I

History of Genetics and Plant Breeding; Cell and cell division; Mendelism. Role of genetics and cytogenetics in crop improvement; Modes of reproduction; Different breeding methods for self-pollinated, cross-pollinated and asexually reproducing crops; Breeding for biotic and abiotic stresses; Variety development technology; Seed production techniques.

Practical: Cell and cell division; Selfing and crossing techniques; Demonstration of Mendelian principles; Methods of collection and analysis of data under different breeding methods.

A.6 Crop Morphology and Physiology (1P) I

Morphology and anatomy of root, stem, leaf, flower, pollination, fertilization and embryology of important crops of India. Cell structure and function, Plant growth and development. Water-relations, mineral nutrition, photosynthesis, respiration, plant growth regulators.

A.7 Crop Diseases and Their Management (1L + 1P) Summer Vacation

Historical account; classification of plant diseases; symptomatology; important diseases of cereals, pulses, oilseeds, fibre and vegetable crops; structure and taxonomy of plant pathogens; isolation and identification, diagnosis of plant diseases; disease epidemiology and assessment; integrated disease management including seed certification.

A.8 Agricultural Economics (1L + 1P) Summer Vacation

Definition, nature and scope of Economics. Theory of Demand-Elasticity of Demand-Utility and indifference curve analysis. Theory of supply-cost curves-Nature of supply in agriculture. Price determination in perfectly competitive markets. Concepts of national income. Nature and scope of farm management. Principles of farm management. Farm planning and budgeting. Farm survey. Agricultural Finance-Classification and cost of farm credit-3R's and 3C's of credit. Agricultural Financing Institutions. Cost-benefit analysis of projects. Marketing of agricultural inputs and outputs. Functions and channels of marketing. Agricultural Marketing Institutions.

A.9 Basics of Extension Education (2L + 1P) Summer vacation

Objectives, phylosophy and principles of Extension Education. Historical development of Extension Education and Community Development in India. Ongoing Agricultural Extension Programmes at national level. Basic Principles of teaching-learning processes. Extension teaching methods and Audio-Visual aids. Concept of rural society, social institutions, rural value-systems-culture, norms, process of socialization. Concept and elements of communication. Media of communication-mass, group, interpersonal and traditional.

Practical: Preparation and use of visual aids-posters, charts, flash cards, flannel graphs, etc. Handling of Audio-Visual equipment-epidiascope, over-head projector, slide projector, film projector, tape recorder, VCR, P.A. system, etc. Exposure to village institutions, extension projects and block development organizations.

XXII Other Courses

Agricultural Information System (AIS) **(1L) I-III**

(This Course can be offered in addition to 15 regular credits in a trimester)

1. Role of Library as an institution for informal education;
2. Agrobiological information—nature, basic concepts and definition etc.;
3. Fundamental types and forms of documents, their acquisition and processing;
4. Resource utilization—tools, reference and information service, facilities including existing resources, Selective Dissemination of Information (SDI) and Current Awareness Services (CAS);
5. Literature search strategies—Subject Analysis, indexes, art of indexing & abstracting, evaluation including problems of storage and retrieval of information(with practical demonstrations):
6. Report writing-editing, compilation of bibliographies.
7. Modern Information Systems, Global Information System (e.g. AGRIS) and use of modern computer technologies such as CD-ROM databases etc.;
8. Familiarization with reprography services including use of Microfilms, Microfiche, etc.

Course on English Language (to be audited) **(3L) II**

(1) Parts of speech; (2). Sentence formation and forms of Sentences; (3). Forms of Verbs; (4). Tenses; (5). Active and Passive Voice; (6). Use of Articles; (7). Spellings; (8). The Direct and Indirect Speech; (9). Degrees of comparison; (10). One word substitution; (11). Written composition (Paragraph, reports, drafts etc.); (12). Reproduction (after hearing a narrative); and (13). Misc.

Annexure-I
(Para 1.1.1)

A. IARI-DECLARATION AS DEEMED UNIVERSITY

Government of India,
Ministry of Education,
New Delhi 1, the 22nd August, 1958/31 Sravana, 1880 Saka

Notification

No. F. 24-44/58-U-5. In exercise of the powers conferred by Section 3 of the University Grants Commission Act, 1956 (3 of 1956), the Central Government, on the advice of the University Grants Commission, hereby declares that the Indian Agricultural Research Institute, New Delhi which is an institution of higher education, shall be deemed to be a University for the purpose of the said act.

Sd/-

N.S. Junankar
Deputy Education Adviser

(Para 1.4.1)

B. RECOGNITION OF THE ASSOCIATESHIP OF THE INDIAN AGRICULTURAL RESEARCH INSTITUTE AS EQUIVALENT TO M.SC. DEGREE OF THE INDIAN UNIVERSITIES

Copy of office memorandum No. F. 17-13/49-T. dated the 8th October, 1949, from the Ministry of Education. Government of India (received under tho Ministry of Agriculture, letter No. 1147 Institute/49, dated the 14th November, 1949).

The undersigned is directed to say that the Government of India have, in consultation with the Federal Public Service Commission, decided to recognise the Associateship of Indian Agricultural Research Institute, New Delhi, an alternative qualification to the M.Sc. degree of Indian Universities covered by the Associateship Diploma of the Institute.

Annexure-II
(Para 6.10.5)

REVISED READY-RECKONER FOR EVALUATING ACADEMIC SCORE OF M.Sc./Ph.D. CANDIDATES*

Let Y be the total academic score based on the performance of the candidate in his/her earlier classes. We may take the academic score as a linear function of the performance of the candidates in earlier examinations. This can be given for Ph.D. candidates as:

$$Y = X_1 + 0.60\ X_2 + 0.25\ X_3 + .15\ X_4$$

where Y = Total academic score

X_1 = Percentage of marks in M.Sc. examination

X_2 = Percentage of marks in B.Sc. examination

X_3 = Percentage of marks in I.Sc. examination

X_4 = Percentage of marks in Matric or High School examination

If a candidate has done M.Sc., B.Sc. and Higher Secondary (X_1, X_2, X_3) his academic score will be obtained as:

$$Y = X_1 + 0.60\ X_2 + 0.40\ X_3$$

where X_3 = Percentage of marks in Higher Secondary examination

If any of X_1, X_2, X_3, and X_4 is greater than 80, the value will be taken as 80 only.

If candidate has obtained his degree in G.P.A. system the following relations may be used:

3 GPA System:

$$Y = 26.7\ G_1 + 16\ G_2 + 6.7\ G_3 + 4\ G_4$$

4 GPA system:

$$Y = 20\ G_1 + 12\ G_2 + 5\ G_3 + 3\ G_4$$

5 GPA System:

$$Y = 16\ G_1 + 9.5\ G_2 + 4\ G_3 + 2.5\ G_4$$

Av. grade obtained in

where G_1 = M.Sc. G_3 = I.Sc.

G_2 = B.Sc. G_4 = Matric

---

*This is not applicable from the academic session 1994-95 onwards.

If the candidate has done only M.Sc., B.Sc. and Higher Secondary, his score will be obtained by giving the same weightage to G_1 and G_2 and weight for G_3 (Higher Secondary GPA) will now be same as the weights of G_3 and G_4 given above.

If a candidate has got percentage of marks in some examination and in some GPA system, his score may also be obtained by suitably combining the two formulae.

For M.Sc. candidates, the following relations are proposed:

$$Y = X_1 + 0.60\ X_2 + 0.40\ X_3$$

where Y = Total Academic Score

X_1 = Percentage of marks in B.Sc. examination

X_2 = Percentage of marks in I.Sc. examination

X_3 = Percentage of marks in Matric and High School examination

If a candidate has done Higher Secondary and B.Sc., his score will be obtained as follows:

$$Y = X_1 + X_2$$

where X_1 = Percentage of marks in B.Sc.

X_2 = Percentage of marks in Higher Secondary examination.

If a candidate has got more than 80 per cent marks in any examination, the corresponding value of X will be taken as 80 only.

In case of GPA system, the following relations are proposed:

3 GPA System:

$$Y = 26.7\ G_1 + 16\ G_2 + 10.7\ G_3$$

4 GPA System:

$$Y = 20\ G_1 + 12\ G_2 + 8\ G_3$$

5 GPA System:

$$Y = 16\ G_1 + 9.5\ G_2 + 6.5\ G_3$$

Where Av. grade obtained in

G_1 = B.Sc.

G_2 = I.Sc.

G_3 = Matric

If a candidate has only B.Sc. and Higher Secondary Examination, the coefficients of G_3

will be added to G_2. If a candidate has got grade point average in some examination and percentage of marks in other examinations, his academic scores will be obtained by suitably combining the two systems:

EXPLANATORY NOTE ON THE READY RECKONER

(1) Group 'A'

This group covers candidates who have taken the following set of examinations:

Matric

Intermediate Science

B.Sc.

M.Sc. (for Ph.D.)

Group 'B'

This group covers candidates who have taken the following set of examinations:

Higher Secondary or Pre University course

B.Sc.

M.Sc. (for Ph.D.)

(2) If a candidate has done Intermediate after Higher Secondary the marks obtained in Higher Secondary only are taken into account and the Intermediate marks are not considered.

(3) The percentage of marks obtained in Higher Secondary or Pre-University/Pre-Medical/Pre-Professional whichever is beneficial to the candidate is taken into consideration, in case of candidates who have taken both the examinations.

(4) In the case of 10 GPA system, the G.P.A. will be proportionately brought down to 5 GPA system and equivalence established under IARI formula.

DEPARTMENTAL STUDENTS

(Rules which were in force prior to 1980-81 academic session and continue to be applicable to departmental part time students admitted earlier).

6.71 A limited number of staff members shall be admitted as part-time students to the regular post graduate courses of the Institute. The rules governing such admission are indicated in the following paragraphs.

Eligibility

6.72 A Bachelor's degrees for admission to M.Sc. and a Master's degree in the concerned discipline for admission to Ph.D. is essential. The degree shall be in agriculture or in the cognate branches of natural sciences, or social sciences or technology.

6.73 Weightage shall be given to the employees for their service experience at IARI at the rate of 2 marks for each completed year of service, in addition to the points for their academic record.

6.74 Only those employees who fulfil the qualifications prescribed and who secure minimum 100 points including service weightage out of 200 points (90 points for candidates belong to SC/ST) as per the IARI ready reckoner, shall be eligible to be called for written test for admission. All staff members who secure 100 points shall be called for interview.

6.75 All officers of the rank of Junior Class I, Class II and Class III shall be eligible provided they have two years of continuous service at the IARI including its sub-stations, in research/teaching/technical fields on the last date prescribed each year for submission of applications. The employees who leave the Institute after serving for two years without retaining their lien, shall not be allowed the benefit of this service when they join the Institute again.

6.76 An employee who is registered for a higher degree with an outside university shall also be eligible, but he shall be permitted to register himself only with one university at any one time, i.e., either with IARI or with an outside university. In case such an employee is selected for admission as part-time departmental candidate, an intimation to this effect will be sent by the P.G. School to the outside university requesting for cancellation of his registration with that university.

6.77 An employee shall be given the facility of admission as departmental part-time student only once, either for obtaining the M.Sc. or the Ph.D. degree to ensure that a maximum number of employees get this facility.

Number of Seats

6.78 For admission of staff members in position on 1.10.77 to M.Sc. course at IARI the following procedure shall be applicable for a period of two years only.

(i) The seats for admission of the departmental candidates shall be worked out separately for M.Sc. and Ph.D. on the basis of existing quota of 20% of the respective strength of the eligible candidates;

(ii) There should be a minimum of one seat in M.Sc. and one seat in Ph.D. in each discipline and this should not be interchangeable, except in discipline where there are no candidates at all eligible for admission to M.Sc. degree.

6.79 The number of departmental part-time students at any time in any discipline shall not exceed 20 per cent of the strength of the eligible staff of the discipline (as per admission standard prescribed), subject to a minimum of 2 seats per discipline at any one time. The eligible staff in the sub-stations and the regional research stations shall be treated as part of the discipline to which the employee belongs.

6.80 The allocation of seats for purposes of admission of part time departmental students shall be discipline-wise with respect to the teaching disciplines approved for teaching. Currently, this shall be with respect to the 15 disciplines approved for teaching. The eligible staff members shall be categorised and listed according to the teaching disciplines and quota of seats calculated accordingly. Every eligible staff member shall be informed about the parent discipline to which he will belong based on academic qualifications and job requirements. He will be given an opportunity to express his views about the disciplinewise categorisation and the final decision about his field of discipline shall be taken after considering his views.

6.81 Whenever a new teaching discipline is set up and if an employee who is also a student is transferred, he shall be shown against the quota of seats of the new discipline.

6.82 The list of eligible employees shall include only those who possess the minimum educational qualifications prescribed. Those employees who have availed or currently availing of the facility as part-time departmental students shall not be included in the list.

6.83 A seat shall be deemed to have been vacated for the purpose of admitting a fresh departmental candidate as soon as an existing departmental part-time student in that discipline has successfully completed his qualifying examination. The qualifying examination of such of those departmental candidates who are due to vacate their seats in a particular academic year shall be held by the 31st March of particular year. This shall be strictly adhered to and individual requests for relaxation shall not be entertained under any circumstances.

PROCEDURE FOR ADMISSION, INTERVIEW, SELECTION ETC.

6.84 The time schedule for admission under this stream shall be suitably advanced (ahead of the admissions through open competition) to give more time for scrutiny of applications and for selected candidates to join. The last date for receipt of applications in the P.G. School from the employees shall normally be the same as the last date prescribed for receipt of applications from candidates for admission under the faculty upgradation scheme or any other date prescribed by the Academic Council from time to time.

6.85 The application of a departmental candidate shall be routed through the Joint Director (Administration) so that alternative arrangements made for carrying on the work are clearly decided even before forwarding the applications.

6.86 Staff members shall be eligible to apply for only one subject depending upon their field of specialisation and area of work.

6.87 At the time of submitting the application for admission, the staff member shall give full information about his establishment, his specialisation, his area of work, etc. (Annexure IV) Applications which are not accompanied by the prescribed proforma (in addition to the application) or incompletely filled proforma shall be rejected outright without seeking any further clarification. If a staff member working in one Division wants to apply for admission to a discipline which is outside his parent Division, the application shall be routed through the parent Division as also the Professor of discipline concerned.

(i) The applications duly filled in including the forwarding proforma (at Annexure-IV) should be submitted to the respective disciplines 15 days in advance of the last date prescribed. The Board of Studies of the discipline concerned, shall scrutinise all such applications in one lot including all the columns of the proforma at Annexure-IV and forward the same to the P.G. School by the last date prescribed. The requirement of attaching two passport size photographs shall not apply to candidates applying for admission under this stream.

6.88 The total weightage for the interview shall be 100 marks and the staff member shall be eligible for admission only if he secures a minimum of 35 marks in the interview.

6.89 If a departmental part-time student is transferred or promoted during the studentship to another post, the Post-Graduate School should be notified. A 'no objection certificate' shall also have to be obtained from the immediate supervisory officer in the new post to the effect that there is no objection to the candidate working with the previous major adviser and on a research problem chosen prior to transfer/promotion. The certificate is necessary and useful in creating a better understanding between scientists. The requests for grant of such certificate should be considered sympathetically. As far as possible, the new supervisor of a departmental student should also be made a member of his Advisory Committee.

6.90 A 'no objection certificate' from the Post-Graduate School shall be obtained before processing the application of departmental part-time student for deputation abroad and these will be governed by the prescribed academic regulations.

6.91 All the other regulations contained in the P.G. School Calender in respect of various subjects shall be applicable to the departmental part-time students also subject to the special provisions mentioned in paras 6.72 to 6.90.

Annexure-IV
(Para 6.27.1)

POST GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

ROSTER FORM

Name:	Full time/Part time	Discipline
Roll No:	Academic Year	Trimester: I/II/III

Course number and tittle	Credit L & P	Signature of Course Instructor

(Student's Signature)
Date

Approved By:
Chairman, Advisory Committee

Instructions

1. Each Post-graduate student on rolls of the School shall complete 3 copies of the roster and submit them through Professor on registration day of each trimester.
2. Prior approval of the Dean is necessary for any deviation from the approved 'Plan of Post-Graduate Work'.
3. "Nil" roster must be submitted even when a student has no course work in a trimester.
4. For the newly admitted students, Professor in the discipline shall be acting as Chairman of their Advisory Committee until the Advisory Committee has been constituted.
5. Permission to take more than 15 credits can be given if extra credits relate to remedial courses.

Annexure-V
(Para 6.27.1)

POST GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI 110 012

Progress Report for Trimester Ending: ________________

1. Academic Year 199 -9 Trimester______________M.Sc./Ph.D. __________
2. Discipline____________________________________Roll No. _____________
3. Name of student ____
4. Date of admission ____
5. Name of Chairman, Advisory Committee________________________________
6. Total No. of credits included in PPW ________________________________
7. Total No. of credits Completed so far trimester-wise

Trimester	Credits	GPA

8. Whether Thesis Problem identified
9. Date of submission of ORW
10. Date of Passing Qualifying Examination
11. Has research work started ? If so, give a resume of the work done so far bringing out the salient points including difficulties, if any.

____

____

____

____

Signature of student

12. (a) Is the statement in column 11 correct ? If not, indicate factual position ___

    ____

    (b) Is the student regularly attending to his approved research work ? _______

13. Date of meeting of the Advisory Committee of the student during the trimester under report ____________________________________

14. Comments of the Advisory Committee ____________________________________

Date: ________________ Signature of Chairman, Advisory Committee

Date: ________________ Signature of Professor

Note:

1. The student should submit this, in duplicate, to his Chairman, Advisory Committee 15 days before the end of each trimester.
2. The Chairman Advisory Committee shall deliver both copies of the Progress Report to Professor of the discipline after recording his comments within 2 days.
3. The Professor shall get the Progress Report reviewed in the Board of Studies well before the start of the next trimester.
4. The Professor shall furnish the duplicate copy of the Progress Report to P.G. School Office alongwith comments of the Divisional Board of Studies.

Annexure-VI
(Para 6.27.1)

POST GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI 110 012

PROFORMA FOR TRIMESTER REGISTRATION

Academic Year_______________ Trimester _____________

1. Name of student ____ M.Sc./Ph.D.
2. Roll No. _______________________ Discipline __________________________
3. Trimester of study ___________________I/II/III/IV/V/VI/VII/VIII/IX/X/XI/XII.
4. Whether progress report of preceding trimester submitted to the Chairman. ___________________________________
5. Date and Amount of fee paid at the Syndicate Bank. ____________________________________
6. No. of credits offered in this trimester (Roster Attached) __________________________________
7. If taking more than 15 credits including remedial courses _______________
   whether application has been submitted for Dean's approval. _______________
8. Research work proposed to be undertaken in this trimester

   ____

   ____

   ____

Date: Signature of student

Certified that course work and research work as mentioned in Col. 6 & 8 above are in accordance with the approved PPW and ORW of student. The student has already submitted his Progress Report of preceding trimester which has been furnished to the Professor.

Signature of Chairman
Advisory Committee

Progress Report Submitted

Date: _______________ Signature of Professor

Dean, P.G. School

Annexure-VII
(Para 8.5)

RULES AND REGULATIONS GOVERNING THE "HOOKER AWARD" FOR AGRICULTURAL RESEARCH LEADING TO INCREASE IN FOOD PRODUCTION

Name of the Award

1. The 'Hooker Award' for Agricultural Research leading to increase in food production.

Donor of the Award

2. Late Mr. & Mrs. Richard Hooker of Longmeadow, Masachusetts, U.S.A.

Nature of the Award

3. A prize of the value of Rs. 5,000/- in cash or kind or both plus a scroll for outstanding research in any field or subject within the purview of research in agriculture, animal husbandry and fisheries. Prize money is exempted from income-tax vide M/Finance order No. F. No. 199/23/83-IT (AI). dated 27.2.1981.

Periodicity of the Award

4. The award shall be made once in two years.

Purpose of the Award

5. To create incentive for research workers in India for the purpose of improving food condition in India.
6. The Award shall be made for either fundamental research or applied research including inventions, discoveries etc. leading to results of practical value in the field of agricultural production.

Administration of the Award

7. The IARI shall retain the right to designate the general field of endeavour in which the Award shall be made.
8. The Institute shall have the sole right of selection of the recipients of the award and of the formulation of rules governing such selection.

Eligibility for the Award

9. All research workers engaged in research in the field of agriculture, animal husbandry and fisheries and working at all the institutions throughout the country on improvement

of agriculture, animal husbandry and fisheries in India by way of evolving more productive varieties or techniques leading to better agricultural production shall be eligible for the Award.

10. The award shall be made for notable or original research both fundamental and applied in particular subject as revealed in books, monographs, papers, patents or any other published account of outstanding research work inventions or discoveries. However, contributions or achievements which have received any other award, shall not be eligible for consideration of the Hooker Award.

11. The candidates shall be judged on the basis of results of researches achieved/ contribution made by them during the five years preceding the year of the Award. In the case of claim based on evolution of new varieties, the final trials should have been completed within the 5 years preceding the year of Award.

Screening Committee

12. The Vice-Chairman of the Academic Council will constitute the Screening Committee consisting of 3-5 members concerning the major areas of the subjects pertaining to the applicants for the concerned year for scrutinising the applications.

Judging Committee

13. There will be a Judging Committee consisting of 5 members. The Chairman of the Academic Council will nominate the Chairman of the Judging Committee and its members. The Dean and Joint Director (Education), IARI will be the Member Secretary of the Committee. The quorum of the Judging Committee for finalising the recommendation shall be at least 3 members including Chairman and the Member Secretary.

14. If any member of the Screening Committee as well the Judging Committee himself is to be considered for the Award, he shall cease to be a member of these committees and some other scientists shall be appointed by the Academic Council in his place.

15. The function of the Judging Committee shall be to recommend to the Academic Council the name of the recipient for the Award in accordance with the procedure laid down here-inafter.

16. In the case of jointly conducted research work, the members of the Judging Committee shall recommend to the Academic Council of the Institute a team of co-workers as recipients of the Award as also the proportion and the manner in which the prize money should be divided amongst the co-workers.

Procedure for Selection of Recipients

17. Applications will be invited by the Institute for the Award from Research Institutions and Scientific Societies in India. Each such application, which shall be in the prescribed form, shall be required to be accompanied by an entrance fee of

Rs. 15/- and detailed statements of the work and attainments of the candidate, to be submitted by a specific date.

18. When there is a tie among the recommended candidates, the money of the Award shall be equally divided among the candidates recommended.

19. The Award shall be withheld by the Academic Council if in their opinion no sufficiently meritorious candidate is forthcoming in the year.

20. After the acceptance of the recommendations of the Judging Committee by the Academic Council, the Award shall be announced.

Presentation of the Award

21. The P.G. School of the Institute shall notify the recipient of the Award of his/her selection and request him/her to send a copy of his/her photograph in a suitable size. The photograph along with a thumb-nail sketch and a summary of the contributions/achievements of the awardee may be published in the P.G. School Journal and/or such other publication as may be decided upon by the Academic Council.

22. The Award shall be made at the Convocation of the Institute or any other suitable occasion.

23. At the time of presentation of the Award the recipient shall present an account of his/her contribution/achievement at a special seminar which will be arranged during the Convocation programme.

Annexure-VIII
(Para 8.6)

RULES FOR DR. S.S. BAINS MEMORIAL AWARD

Introduction

Dr. Sher Singh Bains, erstwhile Head of the Division of Agronomy, Indian Agricultural Research Institute, New Delhi was deeply interested in improving the plight of farmers with small holdings through increased cropping intensity. His pioneering work on relay-cropping, both under rainfed and irrigated conditions, is well-known.

Name of the Award

Dr. S.S. Bains Memorial Award.

Donor of the Award

Scientific staff of this Institute and by Indian Farmers Fertiliser Cooperatives Ltd.

Nature of the Award

A Prize of the value of Rs. 2000/- plus gold medal and a scroll.

Periodicity of the Award

The Award shall be made once in two years.

Eligibility

The Award is open to (i) all scientists working in the field of Agronomy, and (ii) the Ph.D. students who obtain the Doctorate degree in Agronomy from any University in India in the year pertaining the year of award. The candidates should be below the age of 30 years on the last date prescribed for receipt of application.

Procedure

1. The candidate for the award should be nominated by his/her University/Institute. The candidate should send through the nominating authority a copy of the thesis submitted by him for his Ph.D. degree in Agronomy together with six copies of its synopsis running into 5 pages or so giving the details of the research work done by him for his Ph.D. degree and highlighting the significance of the research. The nominations in the prescribed application form should be accompanied by certificate from the concerned Head of the Department that the research contribution of the candidate has been a significant factor in obtaining the data contained in the thesis and subsequent conferment of Ph.D. degree of Agronomy.

2. All the nominations together with appropriate certificates must reach the Member Secretary by the notified date to be announced every year while inviting nominations.
3. The applications should be routed through the University/Institution concerned. The research worker/student, may if he/she so desires, send an advance copy. However, action will be taken only when the application is received duly sponsored by the University/Institution concerned.
4. The work, submitted for some other award, may also be considered for this award.
5. All nominations shall be judged by a Judging, Committee consisting of 5 members constituted by the Chairman of the Academic Council. The Dean and Joint Director (Edn.), IARI will be the Member Secretary of this Committee. The quorum of the Judging Committee for finalising the recommendation should be at least 3 members including Chairman and the Member Secretary.
6. The candidate whose research work is judged to be the best will be awarded the medal and cash ordinarily during I.A.R.I. Convocation. The recipient of the award is expected to deliver an illustrated talk based on his significant research contribution submitted for the award.
7. TA/DA as admissible under the ICAR rules to persons of comparable status shall be paid to the recipient of the award for his journey from his place of work to Delhi and back.

Annexure-IX
(Para 8.7)

RULES AND REGULATIONS GOVERNING THE SUKUMAR BASU MEMORIAL AWARD FOR OUTSTANDING RESEARCH IN RURAL DEVELOPMENT

Name of the Award

1. Sukumar Basu Memorial Award for Outstanding Research in Agriculture including Animal Husbandry and Forestry.

Donor of the Award

2. The award has been donated by late Dr. Sib Das Basu, M.B. DIH; DPH; Ex-Joint Director of Health Service, Govt. of West Bengal, to commemorate the name of his brother, Late Sukumar Basu, ICS, who was for many years concerned with various aspects of Agriculture in the Govt. of India and the Govt. of un-divided Bengal and was also associated with the ICAR in the capacity of its Secretary, Vice-Chairman and Chairman.

Nature of Award

3. A prize of the value of Rs. 10,000/- in cash and a scroll for out-standing research in Agriculture including animal husbandry and forestry. The Academic Council will, however, have the power to vary the amount of the award provided the expenditure is met out of the return on the capital. Prize money is exempted from income tax vide M/Finance order No. F. No. 199/23/80-IT (AI) dated 27.2.81.

Periodicity

4. The award will be made once in two years.

Purpose of the Award

5. To create incentive for research workers in the country for the purpose of improving the quality of life in the villages through improvement of economics of agriculture by research in all fields of agriculture.

6. The award shall be made either for fundamental research or applied research including inventions, discoveries, etc. leading to results of practical value in the field of agriculture production.

Administration of the Award

7. The IARI shall retain the right to designate the general fields of endeavour in which the Award shall be made.

8. The Institute shall have the sole right of selection of the recipients of the award and of the formulation of rules governing such selection.

Eligibility for the Award

9. All research workers engaged in the fields of agriculture, animal husbandry, forestry and fisheries including soil inputs, seeds, agriculture practices, harnessing of energy, livestock, pisciculture, desertification, afforestation, timber, etc. and working at all the institutions throughout the country in India by way of evolving outstanding research in Rural Development, more productive varieties or techniques leading to better agricultural production shall be eligible for the award.

10. The award shall be made for notable or original research both fundamental and applied in particular subject as revealed in books, monographs, papers patents or any other published account of outstanding research work inventions or discoveries. However, contributions or achievements which have received any other award, shall not be eligible for consideration of the Sukumar Basu Award. The papers should have been accepted for publication in an Indian or International Journal of high academic standing.

11. The candidates shall be judged on the basis of results or researches achieved/ contribution made by them during the five years preceding the year of the award. In the case of claim based on evolution of new varieties, the final trials should have been completed within the 5 years preceding the year of Award.

Screening Committee

12. The Academic Council of the Institute shall appoint a Screening Committee for each major discipline, whose duty shall be to scrutinise all applications received in a particular major discipline and thereafter to recommend the best candidates for the consideration of the Judging Committee. The Screening Committee shall consist of three scientists belonging to the particular discipline.

Judging Committee

13. (a) There will be a Judging Committee which will be appointed by the Chairman of the Academic Council. The Committee shall consist of at least 5 members and the Dean & Joint Director (Edn.), IARI will be the Member Secretary of the Committee. The quorum of the Judging Committee for finalising the recommendation shall be at least 3 members including Chairman and the Member Secretary.

    (b) The Vice-Chairman of the Academic Council will constitute the Screening Committee consisting of 5 members concerning the major areas of the subjects pertaining to the applicants for the concerned year for scrutinising the applications.

14. If a member of the Screening Committee as well as the Judging Committee himself is to be considered for the award, he shall cease to be a member of these committees and some other scientist shall be appointed by the Academic Council in his place.

15. The function of the Judging Committee shall be to recommend to the Academic Council the name of the recipient for the Award in accordance with the procedure laid down hereinafter.

16. In the case of jointly conducted research work, the members of the Judging Committee shall recommend to the Academic Council of the Institute a team of co-workers as recipients of the Award as also the proportion and the manner in which the prize money should be divided amongst the co-workers.

Procedure for selection of recipients

17. Applications will be invited by the Institute for the Award from Research Institution and Scientific Societies in India. Each such application, which shall be in the prescribed form shall be required to be accompanied by an entrance fee of Rs. 15/- and detailed statements of the work and attainments of the candidate, to be submitted by a specific date.

18. When there is a tie among the recommended candidates, the money of the Award shall be equally divided among the candidates recommended.

19. The Award shall be withheld by the Academic Council if in their opinion no sufficiently meritorious candidate is forthcoming in that year.

20. After the acceptance of the recommendations of the Judging Committee by the Academic Council, the Award shall be announced.

Presentation of the Award

21. The P.G. School of the Institute shall notify the recipient of the Award of his/her selection and request him/her to send a copy of his/her photograph in a suitable size. The photograph alongwith a thumb-nail sketch and a summary of the contributions/achievements of the awardee may be published in the P.G. School journal and/or such other publication as may be decided upon by the Academic Council.

22. The Award shall be made at the Convocation of the Institute or any other suitable occasion.

23. At the time of presentation of the Award the recipient shall present an account of his/her contribution/achievement at a special seminar which will be arranged during the Convocation programme.

Annexure-X
(Para 10.1.2)

INDIAN AGRICULTURAL RESEARCH INSTITUTE
POST-GRADUATE SCHOOL

Plan for Post Graduate work for M.Sc./Ph.D. degree

Name of the student: Roll No.:

Part-time/Full time: Date of enrolment:

Main subject (discipline):

Major field: Minor Field(s):

Proposed research problem (Thesis title):

Departmental part-time students shall be allotted a research problem in their primary area of work and only within the frame work of approved research project in which they are deployed. This may be certified.

Degrees/Diploma earned elsewhere:

Institution/University	Subject	Year	Percentage of marks/grade
....	....	....	....
....	....	....	....

Number of credits of course assignment recommended in major and minor: (Details overleaf)

Whether the prescribed core courses included ?

Programme approved by the Advisory Committee:

	Name & Designation	Signature
1. Chairman		
2. Co-Chairman		
3. Member		
4. Member		
5. Member		
6. Member		

Recommended: Approved

Professor: Dean:

Date: Date:

Details of Course Work Proposed

Course number and title	Term	Credits	Grade

In Major fields:

In minor fields (two for Ph.D. and one for M.Sc. students)

In other fields, if any:

Remedial courses (for non-agriculture graduates)

Annexure-XI
(Para 10.3.3)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Proposal for the formation of student's Advisory Committee

1. Name of the student and Roll No.:
2. Year of Admission:
3. Degree: M.Sc./Ph.D.
4. Part time/Full time:
5. Discipline:
6. Major field:
7. Minor field(s):
8. Composition of Advisory Committee: Signature with date

(i) ....

Chairman

(ii) ....

(iii) ....

(iv) ....

(v) ....

Proposed by: (Professor)

Recommended by: (Head)

Date: Approved by: (Dean)

(a) No faculty member can function as Chairman of more than 5 students including part-time departmental and those registered with outside universities.

(b) No faculty member can function as a member of the Advisory Committee of more than 10 students.

(c) No faculty member admitted as part-time departmental student at the P.G. School or registered with another university for a higher degree shall be eligible to function either as Chairman or member of the Advisory Committee.

(d) The Chairman of Advisory Committee in respect of departmental student to be finalised as per para 10.3.5 and 10.3.6 of the P.G. School calender.

Annexure-XII
(Para 10.3.4)

REVISED GUIDELINES REGARDING NOMINATION OF CHAIRMAN AND ASSIGNMENT OF RESEARCH TOPICS TO THE NEWLY ADMITTED STUDENTS

(Approved on 13th September 1982)

1. Prior to start of the academic year, even before selection of new students, the Professor shall request all faculty members of his discipline to indicate whether they would like to be nominated as Chairman of the Advisory Committees of M.Sc./Ph.D. students in that particular year. Those who have not guided 2 M.Sc. students will be eligible to guide only M.Sc. students.

2. Based on the above information, the Professor of each discipline shall issue a notice listing the names of faculty members available for guidance of M.Sc./Ph.D. students and the area of specialisation of each such faculty member. (In cases of doubt regarding the area of specialisation, this may be ascertained from the faculty member concerned and got confirmed by the Head of the Division, if necessary with reference to the approved Divisional Research Projects of the Scientists concerned). The names of Chairman already guiding 3 students should be circulated with asterisk mark indicating that they are already having 3 students. Normally, the students choice will be considered for such of those faculty members who have less than 3 students; and only in the event of non-availability of faculty member in the discipline, the names of faculty members having more than 3 students will be considered for allotment of students. However, even in the latter case no faculty member shall be allowed to guide more than 4 students at any time.

Note: *In the Divisions where there are large number of faculty members who have not guided even M.Sc. students, the faculty members who are eligible to guide Ph.D. students should not be allotted M.Sc. students and the names of such faculty members should not be circulated to M.Sc. students while calling for their choice of Chairman. The senior faculty members can, however, be nominated as No. 2 in the Advisory Committee of the students.*

3. During the Orientation week, the newly admitted students may be encouraged to freely meet the different faculty members in the discipline and discuss possibilities of research problems in their respective areas of specialisation. After allowing a reasonable time for such discussions (say about a week or 10 days), the Professor shall ask each student to submit a list of three choices of Chairman by name and the proposed fields of investigation as he wishes to undertake as precisely as possible in the area of specialisation of the proposed Chairman.

4. A meeting of the Board of Studies will then be convened to consider the choices exercised by the students and decide on the nomination of the Chairmen of each student. The Board will normally agree to the choice of the student in the order of preference. Whenever there are ties in the choice of Chairman or there are other important considerations, this may be decided in favour of the student with better

rank in the merit list prepared at the time of selection. The final decision rests with the Board of Studies. In the case of students under the FUS scheme, foreign students and ICAR nominees, the Board may give the consideration also to special requests, if any, received from their sponsors, the candidate's own background and area of specialisation in which he has been working prior to joining IARI etc.

5. A faculty member shall not be nominated as Chairman of a Ph.D. student unless he has already guided two M.Sc. students.

6. As per existing rule, a faculty member may be nominated Chairman of only one student in a year and of a maximum of three students at a time. However, in disciplines where the strength of the faculty is not adequate or for any other reason supported by proper justification, the Board of Studies may recommend relaxation in the operation of this rule in specific cases in terms of guidelines contained in para 2 above. The Dean may give relaxation after considering each such case on merit, but not more than 4 students at a time and more than 2 students in a year in any case.

7. The Professor shall obtain the final approval of the Dean before announcing the nominations of Chairmen of the newly admitted students finalised by the Board of Studies.

8. The nomination of Chairman of Advisory committees of all newly admitted students should be completed by the middle of the 1st trimester and proposals for constitution of Advisory Committees sent to the Dean before the end of the trimester.

9. While the broad field of investigation to be assigned to each student would already have been identified at the time of nomination of Chairman of Advisory Committees, it may take some time to decide on a specific research project and its title. In doing so, the Chairman, Advisory Committee may not suggest specific projects themselves, but encourage initiative and independent thinking, especially on the part of Ph.D. students, in proposing projects, in the formulation of the technical programme and the techniques to be followed.

10. The thesis title alongwith ORW will have to be approved by the Advisory Committee and forwarded by the Chairman of the Committee to the Professor by the beginning of the 3rd trimester. All the thesis problems will have to be first considered by the Board of Studies. The Board may invite the faculty member and the student concerned for discussion and if necessary make constructive suggestions for modification and improvement of the project so as to conform to standards expected of M.Sc./ Ph.D. theses. After approval by the Board, the ORW will be presented in the Divisional Seminar for their suggestions and approval. It is the responsibility of the student and his Chairman to incorporate all useful suggestions in the ORW and get it forwarded to the Dean's office for approval before the end of the 3rd trimester.

11. It is clarified that thesis projects of students should not be part of the approved Divisional project of the faculty member concerned, but may be related to the latter and should be consistent with the facilities available with the faculty member and the Division. The research projects should not be of a routine nature but

should have a major emphasis on originality and development of new concepts, models, methodologies and techniques.

12. Subject to the above modifications, all the other provisions in the existing rules and regulations will continue to be followed.

Annexure-XIII
(Para 10.4.4)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Proforma for Introduction of New Courses/Revision of Courses

1. Name of discipline in which course is to be listed:
2. Title of the course and course no:
3. Course content:
4. (a) Number of credits:
   (theory and practical)
   (b) Number of theory lectures
   per week and duration
   (c) Number of practical lectures
   per week and duration
5. To be offered: Trimester No.: Yearly/Odd year/Even year
6. Need for new course/revising the course:
7. Relation to other course:
   (a) Pre-requisite(s) if any:
   (b) This course is to be a formal
   pre-requisite for course no.
   (c) In your judgement, does this course overlap
   to a considerable extent, with any other course
   whether in your discipline or in another discipline ?

   If so, Please name the common topic and the course

Topic	Course
(i)	(i)
(ii)	(ii)
(iii)	(iii)

Please indicate the reason why overlapping is justified.

8. Would the introduction of this course necessitate any addition to the staff strength of the division concerned ?
9. (a) Name of the course leader:
   (b) Name(s) of alternate course leader(s):

10. Topical outline of course separately for theory and practicals (give under major and minor heading the principal topics covered in this course together with the approximate number of class hours to be devoted to each topic. Please be specific and inclusive).

11. List of reading and reference material required for the course:

12. Class room, laboratory, equipment and other facilities required and whether they are available:

13. **Examination and Weightage:**

Type of Examination	Number	Weightage to be given for final grading (in terms of %)
(a) Quizzes		
(b) Mid term		
(c) Term paper/assignment		
(d) Practical		
(e) Final		
(f) Other type of examination.		

14. Sequence of action:

Request prepared by: Date:

Approved by the Board of Studies Date:

Approved by the Standing
Committee on Course,
Curricula and Academic Affairs Date:

Approved by the Academic Council Date:

Annexure-XIV
(Para 10.12.2)

PROCEDURE FOR SEMINAR BY STUDENTS

An M.Sc. student is required to give atleast two seminars in the major field and a Ph.D. student three seminars (one of which should be in the minor field outside the discipline) during the course of the study at this school. The object of the seminar is to judge the student's capability to present a critical survey of the subject matter, mode of presentation, capacity to draw general conclusions from literature and ability to answer questions relevant to the seminar topic during the discussions.

1. General

Seminars will be usually held on a fixed day in the lecture theatre of the Division. Notices should be circulated well in advance to the members of staff and students of the discipline and the members of the Advisory Committee. A register shall be maintained to record attendance at the seminar.

2. Selection of Topics

The topic for the seminar should be relevant to the discipline.It should not fall within the purview of the object of the student's thesis but instead should cover a subject of topical interest. Certain relaxations may be allowed for the M.Sc. students. The Seminar Leader in each discipline shall be free to select a seminar topic in consultation with the student and if necessary in consultation with the faculty members concerned. In the case of seminar to be offered in a minor field, the Professor of the minor discipline should also be consulted. The Seminar Leader in consultation with the Professor/Head of the Division shall fix up the schedule for the seminars. Except under the unavoidable circumstances, the seminar date thus fixed will not be changed.

3. Synopsis of the Seminar

Each student will be required to submit to the Seminar Leader the synopsis of the seminar with the approval of the Chairman of the Advisory Committee. The office will arrange to have sufficient number of monographed copies of the synopsis for distribution to the persons attending the seminar. The synopsis should precisely state the main theme of the talk and should bring out clearly and briefly (limited to about 300 words) the entire subject matter to be dealt with during the talk. It should be well written so as to be easily understood and should be self-explanatory, complete and clear in itself.

4. Seminar Evaluation

The Board of Studies may appoint a Seminar Evaluation Committee consisting of 3-4 faculty members with one Seminar Leader. This Committee may assess the performance of the students, taking into account all the relevant factors like introduction and review of literature, presentation of subject, capacity to draw general conclusions from literature and ability to answer questions and allot the grade to the students.

The Seminar Evaluation Committee shall award the grade (A = above 80; b = 71-80; C = 61-70 and D = 51-60). For sending the result of the Seminar, the proforma meant for forwarding trimester examination result should be used.

5. Seminar Write-up

The student shall prepare a full account of the subject covered in the seminar keeping in mind the points raised during the discussion (this should not normally exceed 3,000 words) and submit the same to the Seminar Leader within a fortnight from the date of giving the seminar. The evaluation report of the seminar will not be forwarded to the Dean's Office until the condition is fulfilled.

Annexure-XV
(Para 10.13.1)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Outline of Research Work

1. Name of the student :
2. Roll No. :
3. Discipline :
4. M.Sc./Ph.D. :
5. Date of joining the P.G. School :
6. Major field :
7. Minor field :
8. Title of the thesis :
9. Objectives :
10. Previous work done :
11. Programme of research work :
12. Methodology :
13. *Facilities required & their availability

Date: Signature of student

Recommended by:

1. Advisory Committee: (a) (Chairman)
(b)
(c)
(d)

Certified that the ORW of the student has been formulated and finalised in accordance with the procedure prescribed in para 9.13.2 of the Calender.

2. Professor Date:
3. Head of the Division Date:
4. Approved by the Dean, P.G. School: Date:

---

*Please indicate here whether facilities required are available in the same Division or outside e.g., inter-disciplinary units. If available outside, indicate whether the consent of the concerned establishment and the officer has been obtained.

Annexure-XVI
(Para 11.3.4)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Proforma for Forwarding Final Trimester Examination Result

Academic Year: Trimester:

1. Course Code No. Title Credits (L + P):
2. Name(s) of instructor(s):
   1.
   2.
   3.
3. Details of classes

   Lectures (No.) Scheduled: Given:

   Practicals (No.) Scheduled: Given:
4. *Examination held* *Date on which held*

   Quiz:

   Mid-term:

   Final Theory:

   Practical:
5. Invigilation done by:
6. Date of despatch of result:
   (Result should be sent within 7 days of the examination)
   Reasons for delay, if any:
7. Analysis of grading (Give details of result overleaf)

   No. of students who took the examination:

   No. of students obtained grades:

	A	B	C	D	F	Audited
M.Sc.						
Ph.D.						
Total:						

8. Please enclose one copy each of the Question Papers given for the final examination:

Trimester Final Examination Result for Course Code No.

To check the attendance requirement indicate here the number of Lectures/Practicals equal to 75 or nearest higher percentage of the total Lectures/Practicals given:

Roll No.	Name of the student	Lectures/Practicals No. of classes attended		Grade Awarded*	Remarks
		L	P		
A. Students of P.G. School, IARI					
B. **Others					

It is certified that:

1. the type of examinations and the weightage attached to each course including practicals had been announced by me at the commencement of the trimester;
2. the grades have been declared to and discussed with the students concerned as per para 10.3.4 of PGS calender; and
3. the course Evaluation Proforma was obtained by me duly filled in by the concerned students (Annexure XXXIII).

Forwarded to the Dean, P.G. School — Signature

Date

Signature of Professor — Name & designation

Date: — (Course Instructor)

Note :

1. *If the course was audited please indicate "audited" in this column with remarks "satisfactory/unsatisfactory".
2. **Results of candidates registered with outside universities and others.
3. Course instructors may themselves declare the grades to the students at the end of evaluation and discussion with the students shall be completed within 2 days of such declaration and that grades communicated to P.G. School through Professor within 7 days of date of examination.

Annexure-XVII
(Para 11.5.1)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Grade Card

Name of the student:

Roll No.:

Academic year: Trimester No.: M.Sc./Ph.D.:

Discipline:

Course code no. and title	Credits (L + P)	Grade

Date: Signature: Assistant Administrative Officer (PGS)

Annexure-XVIII
(Para 11.6)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI 110 012

M.Sc./Ph.D. Transcript

1. Name and roll number:
2. Permanent address:
3. Date of birth:
4. Institution last studied and degree obtained:
5. Date of admission at IARI:
6. Subject:

    Major:

    Minor(s):

7. Qualifying Examination passed on:
8. Title of thesis:
9. Thesis submitted on:
10. Final thesis *viva voce* examination passed on:
11. Details of courses credited: (see reverse)
12. Overall grade point average:
13. Participation in Extension activities:
14. Participation in co-cirricular and extra curricular activities:
15. Conduct:

New Delhi

Date: Signature:

Name Roll No.: Subject:

Details of the course work and Grade Point Average obtained

Trimester	Course Code No.	Descriptive title of course	Credits	Grade

Remarks

Total:

Overall Grade Point Average:

Note:	(1)	Excellent	A (4 grade points per credit)
		Good	B (3 grade points per credit)
		Average	C (2 grade points per credit)
		Poor	D (1 grade point per credit)
		Failure	F (0 grade point per credit)

(2) G.P.A. = Total points earned
divided by
total credits taken

(3) One hour lecture or three hours practical per week for 12 weeks carries one credit hour.

Confidential
Annexure-XIX
(Para 11.7.2)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Proposal for Holding the M.Sc./Ph.D. Qualifying Examination

(Please see note overleaf)

1. Name of the student:
2. Roll No.:
3. Field of study Major and Minor(s):
4. Year of admission:
5. (a) Total course work assigned (as per PPW): Credits
   (b) No. of credits of course work completed upto the last trimester:
   (c) Percentage of (b) to (a):
6. Overall Grade Point Average earned:
7. Whether Examination fee paid:
8. Advisory Committee members: 1.
   (Other than the Chairman) 2.
   3.
   4.
9. Name proposed for co-option of one additional member on the Examining Committee (*Please see note*).

	Name	Office & Address	Category
1			
3			

Date: Signature of Chairman, Advisory Committee

10. Two additional names, proposed

	Name	Office & Address	Category
1.			
2.			

Head of the Division

No.

Professor

Dated:

To

Dean,
Post-Graduate School, I.A.R.I.

Note

1. This proposal shall be completed in triplicate by the Chairman of the student's Advisory Committee (with the help of student's PPW and grade cards with him) and submitted to the Professor in duplicate not later than 15 days from the commencement of the trimester in which the examination is proposed to be held. Only one copy of the proposal shall be forwarded by the Professor to the Dean, confidentially, within the next one week. Entire examination must be completed within three months from the date of Dean's permission.
2. The qualifying examination must be completed at least three months in advance of the proposed date for completion of programme for the degree in case of M.Sc. Students and six months in the case of Ph.D. Students.
3. For being eligible to appear in the Qualifying Examination a student should have completed at least 75% of the course work prescribed as per PPW separately in major and minor fields and earned a grade point average of not less than 2.70 in the case of Ph.D. and 2.40 for M.Sc. students calculated on the basis of all courses taken. In the case of courses repeated, the grades obtained both in the original and the repeated course shall be counted for calculating grade point average.
4. A panel of three specialists may be given. In the case of Ph.D. students, the specialists should be in the major field of the student but outside the Institute (including IASRI) and its sub-stations/centres. In the case of M.Sc. students the specialists shall be from the Post-graduate faculty but outside the major discipline.
5. Professor, should suggest two more names. In case of Professor being the Chairman of the student's advisory committee, the Head of the Division should suggest two additional names of examiners.

Confidential
Annexure-XX
(Para 11.11.1)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Report on the Ph.D./M.Sc. Qualifying Examination

Name of the student: Roll No.:

Major field of specialisation:

The Examining Committee hereby certify that in their judgement the above named student has Passed/Failed in the *Qualifying Examination Viva* which has been held this day the and *Recommended/Do not Recommend* that this student be admitted to the *Candidacy* for the degree of *Doctor of Philosophy/Master of Science* of the Institute.

		Signature
Chairman	:	
Co-opted Member	:	
Member	:	
Member	:	
Member	:	
Member	:	

Findings of the Committee:

1. The student should be encouraged to proceed/discouraged from proceeding.
2. The student should add to the programme of study the following:
3. The student should modify the approved programme of study as follows:
4. Other comments, if any:
5. Certified that, except for the addition of the Co-opted member nominated by the Dean, the Examining Committee given above is the same as the approved Advisory Committee of the student or the change in the Examining Committee from that of the approved Advisory Committee of the student has been duly approved by the Dean, Post-Graduate School.

Chairman Examining Committee

No. Date:

To

The Dean, Post-Graduate School Signature of Professor

Note: The oral examination shall be held only after the written examination has been successfully completed. If a student fails in one or more subjects in the written examination, the Examining Committee shall make specific recommendations as to whether the candidate is to be re-examined only in that/those subject. Similarly if a student fails in the oral examination, the Examining Committee shall specifically recommend as to whether the candidate is to be re-examined in the oral examination alone or in the written portion as well.

Confidential
Annexure-XXI
(Para 11.15.1)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Proposal for Submission of Ph.D./M.Sc. Thesis

Part I: To be neatly filled-in or typewritten by the student and submitted in duplicate to the Chairman Advisory Committee, not later than two months before the proposed date for submission of thesis.

1. Name in full:
   (in block letters)
2. Roll No.:
3. Discipline:
4. Date of joining:
5. Proposed date of submission of thesis:
6. Approved thesis title:
7. Total course work assigned (including additional course work; if any, assigned at the qualifying examination): Credits
8. Total course work completed (upto the last trimester): Credits
9. Trimester in which course work completed/proposed to be completed:
10. Overall Grade Point Average earned:
11. Qualifying Examination passed on:
12. (a) Major field of specialisation: (b) Minors (i)
    (ii)
13. Advisory Committee: 1. Chairman
    2.
    3.
    4.
    5.

Date: (Signature of the student)

Part II.—To be completed by the Chairman (after checking Part I above and one copy submitted to the Dean through the Professor and Head of the Division.

14. *Suggestions about names for appointment as examiner for thesis adjudication:

Name, Designation & Address Category**

1.

2.

3.

Date: Signature of Chairman, Advisory Committee

15. Two additional names proposed***

1

2.

Head of the Division Professor

To the Dean, Post Graduate School, IARI.

1. *Three examiners may be proposed by Chairman.
2. **Kindly indicate if the proposed officer is a Central Government employee/State Government employee/University employee/Employee of an Autonomous Body/ Non-official.
3. ***Professor should suggest two additional names. In case of Professor being the Chairman, the Head, should suggest two additional names.

Annexure-XXII
(Para 11.17.5)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Report on Thesis and Final Viva-voce Examination

1. Name of the student:
2. Roll No.:
3. Venue of the Examination:
4. Date of Examination:
5. Discipline:
6. Degree: *Doctor of Philosophy/Master of Science*
7. Major field of specialisation:
8. Thesis title:

The Examining Committee hereby certify that they have examined the above mentioned thesis presented by the above named candidate and after going through the report(s) of the External Examiner(s) on its adjudication, have finally conducted a viva-voce. In the judgement of the Examining Committee the candidate has SATISFACTORILY MET/FAILED TO MEET SATISFACTORILY the requisite standard of performance in these respects for the award of the Ph.D./M.Sc. degree.

Signature

Chairman
Co-opted Member
Member
Member
Member

(a) Certified that the typographical and other errors/omissions pointed out by the External Examiner(s) in their assessment of the thesis as also by the Examining Committee at the final viva have been corrected by the candidate, and the thesis approved by the Advisory Committee.

(b) Certified that the required number of copies of thesis duly bound have been deposited in the Central Library and Divisional Library.

(c) Remarks, if any:

Forwarded:

Signature of Professor (Chairman, Examining Committee)

To the Dean, P.G. School, I.A.R.I.

Annexure-XXIII
(Para 12.2.1)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Proforma for Relief of Students Pending Submission of Thesis

1. Name of the student: Roll No.: (M.Sc./Ph.D.)
2. Full-time or part-time:
3. Date of enrolment:
4. Details of scholarship held (ICAR, IARI etc.):
5. Details of work completed:
   - (i) Credits taken and completed:
   - (ii) Date of qualifying examination:
   - (iii) Whether seminars have been completed:
   - (iv) Whether research work and analysis of data completed:
6. Expected date of submission of thesis:
7. Reasons for requesting relief before the date of submission of thesis. (if taking up employment, indicate employer's name):
8. In case of accepting outside employment, whether application was routed through the Dean:
9. Date from which relief sought:

I. I undertake to pay the tuition fee of Rs. 25/- per month from the date of relief till the date of submission of thesis.

II. I undertake that I will submit my thesis within a period of one year from the date of relief failing which action may be taken against me as per para 12.2(g) of the PG School Calendar.

Date: Signature of student

Comments of the Chairman, Advisory Committee.

Chairman

Recommended and Certified:—

(i) That he has completed all course work including research work and seminar except writing of thesis.

(ii) That he has fulfilled the minimum requirements regarding residence and attendance.

Date: Signature of Professor

Annexure-XXIV
(Para 15.10.1)

NORMS, GUIDELINES AND RULES FOR BOARDING ARRANGEMENTS IN THE P.G. HOSTELS, IARI

I. Membership

1. The membership of the different messes run in the P.G. Hostel will be open to the resident students of the P.G. School. On admission they will be required to pay an entry fee of not less than Rs. 30/- (non-refundable) and an advance equal to monthly charges accruing in the concerned mess (refundable after adjustment).
2. On recommendation of the Mess Secretary, the Master of Halls after satisfying himself that inclusion of an outsider will not jeopardise the interests of the existing members, may permits non-resident IARI PG students and IARI staff members only to take their meals in the particular mess. Entry fee for such non-resident member will not be less than Rs. 60/-. These outsiders will have no say in the organisation of the messes.
3. The ceiling of the membership in the existing messes will be as follows:

Sl. No.	Name of the kitchen	Min. resident student members	Maximum number permissible
1.	2.	3.	4.
(i)	Kitchen No. 1; Hostel No. 1 & 2 (fitted with gas burners)	40	60
(ii)	Kitchen No. 2, Hostel No. 1 & 2 (fitted with gas burners)	40	60
(iii)	Kitchen No. 3, Hostel No. 1 & 2	25	40
(iv)	Kitchen No. 4, Hostel No. 1 & 2	25	40
(v)	International Students' Mess	Open for all foreign students	
(vi)	Kitchen in Hostel No. 3 (fitted with gas burners)	30	60
(vii)	Kitchen in Hostel No. 3 (Eastern wing)	20	35
(viii)	Kitchen in Hostel No. 3 (Eastern wing)	20	35
(ix)	Kitchen in Girls' Hostel (Restricted to lady students' only)	No limit	No limit
(x)	Licencee's Mess Hostel No. 4	No limit	No limit

4. Each resident student is absolutely free to join any mess he likes; provided facilities are available in the messes to accommodate him. In case of difficulty, the Master of Halls of Residences should be approached. Any student who wishes to join a new mess should not have any arrears in any mess and will have to produce 'no-due certificate' from all existing messes, before the case is considered for membership in the new mess.

Note: (i) In case the mess has attained the maximum number, a priority list would need to be maintained by the Hostel office. All such applications will be submitted to Master of Halls of Residences and a copy endorsed to the Secretary of the concerned mess for priorities in the waiting list.

(ii) If a member leaves the mess in the middle of the month, the advance paid will not be disbursed pending finalisation of the accounts for the month.

5. A student will cease to be a member of the mess when:

(a) 'No Dues' certificate has been issued by the mess, The rules governing the mess are not abided by.

(b) Payment is in default.

II. Organisation of the Messes

1. There will be one Mess Secretary to supervise and manage the mess. The tenure of the Secretaryship will be only one calender month who will act as liaison between the Master of Halls of Residences and the members and shall be competent to issue "No Dues" certificate to members. The selection of the Secretary will be made by drawing lots in the General Body Meeting which will be called every six months and except in very special circumstances such as appearing in qualifying examination or proceeding on tour, no member will refuse to accept the responsibilities.
2. The Secretary will furnish the list of members to the Master of Halls of Residences by 10th of each month.
3. The Secretary will arrange to collect the mess charges, effect purchases, ensure supply of food to members, maintain the accounts and prepare the final monthly account.
4. The Secretary will also intimate the Master of Halls of Residences at the end of the month the average charges per month for the meals. The Secretary will have to display the accounts for the information and scrutiny of the members who will have free access to the vouchers for inspection, till the 10th day of the following month.
5. The Secretary will be responsible to call and preside over the general body meetings, prepare the proceedings for display or the circulation amongst the members and implement them as desired by the general body. In case there is any vital issue or departure from the set rules, the Secretary will forward a copy of the proceedings to Master of Halls of Residences for information and necessary action.

6. General Body meetings will be convened by the Secretary either on the last day of the month or on the first day of the following month to present the final account by the out-going Secretary. The incoming Secretary will get the menu for the current month approved in the meeting.

7. If the term of the Secretary is to be discontinued in the middle, the general body may elect by drawal of lots any other member as Secretary.

8. (a) The cleanliness of the kitchen, stores and dining premises, will be the direct responsibility of the Secretary of the mess who will take suitable action against defaulter/mess staff.

   (b) The Secretary of the mess will be responsible for the maintenance and upkeep of the furniture and other items of stores belonging to the Institute and loaned out for the use of mess concerned. In case it is observed that stores items issued on loan have been carelessly handled, the mess will have to bear the repairing charges. In case of closure of the mess, the facilities loaned to the mess will be handed over immediately to the Hostel office by the Secretary in whose tenure the closure of the mess comes up. Damages, if any, to stores belonging to the Institute will be evaluated and realised from all the members of the mess including the non-residents if they happen to be the members.

9. Each member of the mess shall abide by the mess rules. In case of violation, the Mess Secretary may terminate the membership of any member in consultation with the general body and the Master of Halls of Residences. The Master of Halls of Residences or his representative should be present at such general body meeting.

10. In the event of any dispute, the matter will be referred to the Master of Halls of Residences, whose decision will be binding on all the members and employees.

11. (a) A list of employees together with their full particulars as to identity, address etc. will be maintained by the Mess Secretary in the prescribed form and a copy of this list will be supplied to the Hostel office. Any change in the employees of the mess will be reported to the Hostel office immediately, and in any case not later than seven days. In case any mess servant is removed from a particular mess for some specific reason, the intimation about the same will be furnished to Hostel office so that Hostel Administration can inform other messes and ensure that the concerned servant is not employed by any other mess. No servant will be allowed to entertain any guest in the hostels.

    (b) It will be compulsory for the mess servants to undergo quarterly medical examination to be conducted by our Medical Officer.

    (c) All mess servants will be issued identity cards.

12. All employees of the mess will be required to abide by and obey a code of conduct prescribed by the Master of Halls of Residences and as such other instructions/orders as are issued from time to time by the Hostel Administration in the interest of well-being of the inmates of the various hostels.

III. General Rules

1. Each member will deposit the mess dues with Secretary by 10th of each month. The list of such members who fail to deposit the same by due date will be communicated by the Secretary to the Master of Halls of Residences who will in turn inform the P.G. School for taking steps to deduct the amount from the scholarship/ pay of the student/staff members concerned.
2. The resident student member who obtains 'No Dues' certificate will not have any say in the management.
3. Persons absenting themselves for a month or more and not notifying their desire to discontinue as mess member shall continue to pay the establishment charges of the mess concerned.
4. No individual member or any group has any right on the permanent and the consumable property of the mess. Due to any reasons at any time if the mess completely dissolves, the valuation of the mess property will be done and equally distributed amongst the existing members only with the consent of the Master of Halls of Residences.

Annexure-XXV
(Para 16.3)

CONSTITUTION OF THE POST-GRADUATE SCHOOL STUDENTS' UNION

Article 1. Name

The Union will be called "The Post-Graduate School Students' Union" (hereafter referred to as PGSSU) after the name of the institution, the Post-Graduate School of the Indian Agricultural Research Institute, New Delhi.

Article 2. Aims

The following are the aims and objectives of the PGSSU:

1. To inculcate a spirit of fellow-feeling and mutual contact among the members.
2. To promote the special and cultural welfare of the members and to raise the tempo of athletic activities in the Post-Graduate School.
3. To encourage the intellectual development of the members.
4. To arouse among the members a spirit of social service.
5. To provide an opportunity to the members to train themselves in the art of self-government and group leadership.
6. To promote the consciousness of the members regarding the aims and working of various national and international student organisations and to represent the Post-Graduate School student's body on the national as well as international plane.
7. To find out immediate solution for all such problems as may jeopardise the common interest of the members by meetings, discussions and making suggestions, if necessary, to the concerned authorities.
8. To promote the establishment of close relations between the students and the members of teaching staff of the Post-Graduate School.
9. To maintain contacts with the *ex-alumni* of the Post-Graduate School and Associates of the I.A.R.I., New Delhi.

Article 3. Activities

The above mentioned objectives shall be met with organising various literary and cultural activities as debates, film shows, essay writing competitions, educational trips, sports and games and any other item consistent with the objectives provided that such subjects, which are likely to offend any member on religious and moral grounds and result in national and emotional disintegration or which have been disallowed by Patron shall not be discussed during the activities of the PGSSU.

Article 4. Clubs within PGSSU

With the concurrence of the General Body Meeting special groups like photography, drama, music clubs and the like may be organised.

Article 5. Patron

The Director of the Indian Agricultural Research Institute, New Delhi shall be the Chief-Patron and the Dean and Joint Director (Education), Post-Graduate School of the Indian Agricultural Research Institute, New Delhi shall be the Patron of the PGSSU.

Article 6. Membership

1. Any person who is admitted to the Post-Graduate School as an M.Sc. or Ph.D. student will automatically become a member of the PGSSU. "Departmental" students of the Institute are also eligible for the membership of the PGSSU.
2. Associate member: Any member of the staff of the Indian Agricultural Research Institute, New Delhi would be eligible as an associated member. Associate member shall not have the right to vote.

No person who is not a full member or an associate member of the PGSSU shall make use of the recreational and other amenities in the P.G. Students' Hostels.

Article 7. Subscription

Each member shall pay a sum of Rs. 25/- and each associate member a sum of Rs. 40/- as annual subscription. For this purpose the year shall be the same as the academic year of the Post-Graduate School. Full subscription shall be payable for academic year or a part thereof.

Article 8. General Body

The members and the associate members of the Union shall constitute the General Body of the Union. The General Body shall be the supreme governing body of the Union.

Article 9. Executive Committee

The Executive Committee of the PGSSU will comprise the following elected officers:

(i) President

(ii) Vice-President

(iii) General Secretary

(iv) Games Secretary

(v) Finance Secretary

(vi) Social and cultural Secretary

(vii) The Student Representative to Academic Council will be acting as the ex-officio member and attend to all the Executive Committee meetings as ex-officio member.

(viii) Five Class representatives: One each from first and second year M.Sc. students and one each from the first, second and third year Ph.D. students.

(ix) Literary Secretary

The President will, in addition, have the discretion to co-opt a maximum of two students on the Executive Committee, but the co-opted members shall not have the right to vote.

The Executive Committee will function in collective manner with the members being responsible to the President in all matters. The General Secretary will function as the Principal Executive of the Committee in day-to-day management of the Union affairs. The duties assigned to the office bearers by the Executive Committee will be placed on record in the Union office for guidance.

Article 10. Function of the General Body

1. Every member of the General Body subject to article 9 shall have the right to vote at elections of the Union Executive and in all meetings where a vote is called for.
2. Every member of the Union shall have the right to contest elections for the Union subject to Article 6.
3. Every member of the Union shall have the right to examine the accounts, the minute books and record of the Union provided that he/she gives three days notice of his/her intention to do so to the General Secretary.
4. Every member shall have the right to ask questions in writing on any matter connected with Union and receive reply from the Union Executive. All such questions shall be addressed to the General Secretary.

Article 11. Functions of the Executive Committee

The duties of the Executive Committee shall include:

(i) Preparation of programmes for the year, trimester wise and to ensuring their proper execution.

(ii) The programmes will be finalised after consideration of proposals made by individual office bearers pertaining to their specific charges to pass the budget for these activities. The budget should be placed and passed in a special General Body Meeting by the simple majority of the members present. This special General Body Meeting will be called with at least three days notice.

(iii) To appoint Sub-Committee whenever necessary to help the Secretaries in the execution of their duties particularly on occasions of special importance.

(iv) To appoint delegations for representing the PGSSU in various national and international student activities.

(v) To assist the President in taking decisions on various matters so as to further the cause of the PGSSU.

Article 12. Defalcation of the Funds and the Union Property

In case a member of the Executive Committee is alleged to have committed a breach of the constitution or is charged with a serious offence, such as defalcation of funds or misappropriation of the Union property, the Union Executive shall after investigation and with its own findings and opinion forward the case to the Patron for such action as he/she may deem fit. The member so accused will be given full opportunity to defend himself/herself.

Article 13. Election

(i) The members of PGSSU shall elect the office bearers from among themselves for the term of a year as provided in Article 9.

(ii) The votes shall be non-transferable and each member will have the right to single vote. Associate members will have no right to vote.

(iii) The Patron will appoint an Election Commission headed by the Chairman, which will conduct elections under the supervision of the Patron. The Chairman of The Election Commission shall issue notice inviting nominations at least 72 hours before the last date of accepting nomination papers. Each nomination shall be duly proposed and seconded by two separate members. The Election Commission may co-opt members to help them in the conduct of elections.

(iv) The candidates for offices of the President and General Secretary will be students of at least one year standing in the preceding year.

(v) The Election Commission shall make a summary of nominations filed by the members and immediately pass it on for the perusal of the Patron.

(vi) The Chairman of the Election Commission may arrange a meeting to provide an opportunity to all the contestants to express their views before the general body. Those desirous of speaking should convey their wish in writing to the Chairman of the Election Commission at least 48 hours before the polling commences.

(vii) The Chairman of the Election Commission shall notify along with the date, time and place for polling, the names of the qualified candidates for the various offices as mentioned in Article 9 at least 48 hours but not more than 72 hours before the polling commences.

(viii) The Election shall be by secret ballot system and the candidates shall be returned by an ordinary majority. In case of a tie the decision will be made by a toss/lot.

(ix) The election shall be over within one month of the start of the academic session.

(x) Any conflicts regarding the election shall be resolved by the Election Commission whose decision will be final.

(xi) Any office falling vacant within the first trimester shall be filled on the same lines as the regular election.

(xii) After the first trimester if any office falls vacant the following procedure will be adopted.

1. In case of the office of the President, the Vice-President will automatically take over as President.
2. For the rest of the offices of the Executive Committee, the Executive Committee shall fill up the vacancy by appointing one of the class representatives. The vacancy of class representative shall however, be filled up by re-election from that particular class.

(xiii) The Executive Committee shall hand over the complete charge of PGSSU accounts, goods and record to the new Executive Committee on the expirty of its tenure.

(xiv) If no nomination is filed for any of the position of the PGSSU, the chief patron is authorised to nominate on recommandation of the Dean a student for that position in order to avoid supplementary election and for making PGSSU functional.

Article 14. Meetings.

1. A meeting of the Executive committee shall be called by the President at least once a month and 33% of the membership on this Committee shall constitute the quorum: provided that the date, time and place of such meetings are notified to each member at least three days in advance.
2. An extraordinary meeting of the Executive Committee can be called at any time if at least 33% of members of this Committee give requisition for the same to the President. The quorum of such a meeting shall be 50% of the total membership of the Executive Committee.
3. A General Body meeting of PGSSU may be called if at least 25% of the members send a requisition to the President to that effect, who will call such a meeting within a week of the receipt of such a requisition. The quorum for ordinary general body meeting shall be constituted by 40% of the membership.
4. All the members of the Executive Committee shall be present in all its meetings and in the meetings of General Body of the PGSSU. If they have to be unavoidably absent, they shall always inform the President in writing before the commencement of a meeting. If a member absents himself from two successive meetings of the Executive Committee without informing the President in writing he/she shall cease to be a member of the Committee.
5. Any member shall have the right to ask questions about any matter concerning the PGSSU during the General Body meeting. All questions shall be addressed to the President who may refer them to the officers concerned. If need be, the President may demand time to give answer to any particular question in the next meeting.
6. Any member of the Executive Committee shall be free to ask questions in the

Executive Committee meetings and the questions shall be addressed to the President.

7. A motion, if allowed by the President, shall be carried by simple majority vote.

Article 15. Finance and Audit

1. The Students' Union fees paid annually by the members, associate members and any occasional donations shall contribute towards the finances of the PGSSU. The subscription shall be payable to the Dean's Office, Post-Graduate School towards the PGSSU funds.
2. The money shall be drawn by the Finance Secretary for making payments for the approved items of expenditure only when the withdrawal order is counter signed by the President or any other member of the Executive Committee appointed by the President for this purpose.
3. The President or the General Secretary shall be entitled to incur, at a time, an expenditure of Rs. 20/- under extra-ordinary circumstances without the prior approval of the Executive Committee which will be absolutely essential for any expenditure exceeding the sums mentioned above. The expenditure so incurred should be regularised by the Executive.
4. The account of the annual expenditure of the PGSSU shall be audited by a Chartered Accountant at the request of the Executive towards the end of the term.
5. The Chartered Accountant shall not question the budget allocations approved by the Executive Committee.
6. The Chartered Accountant shall hand over the audit report to the Executive. It shall be displayed on the notice board and published in the Post-Graduate School Journal.

Article 16. General Provisions

1. *Adjournment Motion*

Any adjournment motion can be moved at any time and, if duly seconded, it shall be immediately put to vote. If such a motion is duly carried, the meeting shall be adjourned.

2. *Vote of No Confidence :*

(i) A vote of no confidence may be brought against any member of the Executive Committee (except class representatives) for violation of constitutional provisions, neglect of duty or unbecoming conduct if 20% of the members of PGSSU and a requisition for the same to the Patron and if the latter agrees to the validity of the grounds on which the requisition is based, he shall allow it to be moved. It shall be considered effective only when a simple majority of the members present in the General Body of the PGSSU approve it in an extraordinary meeting. The notice for such a motion shall be issued at least a week in advance of the meeting of the General Body of the PGSSU.

(ii) In case of class representatives, lack of confidence may be expressed by the class itself. In such a case at least 25% of the students of that class shall be required to send a requisition to the Patron intimating their desire for the recall of the representative. If the Patron agrees to its validity and allows the motion, he will arrange to call a class meeting and decide the issue by a simple majority vote. At least 3/4 of the members of that class shall constitute the quorum of such a meeting.

3. *Amendments*

The provisions of this Constitution may be amended in an extraordinary meeting of the General Body of the PGSSU by the simple majority of the members present.

4. *Interpretation of the Constitution*

Any dispute relating to the interpretation of the constitution shall be settled by the Chief-patron whose decision shall be final.

(Adopted in the General Body Meeting of the Post-Graduate School Students' Union held on the 19th September, 1964 and amendments made from time to time).

Annexure-XXVI
(Para 16.5)

CONSTITUTION OF STUDENTS' WELFARE FUND

1. **Name: Students' Welfare Fund**

2. **Objectives:**

   (i) To advance loan to individual students in case of necessity arising due to delayed payment of their salary, scholarships. etc.

   (ii) To grant aids to students in event of distress.

   (iii) To grant financial assistance to any other students' activity deemed desirable by the Administrative Body.

   (iv) To grant loan to meet the railway fare on study tour.

   (v) To grant loan in emergency conditions while the student has to go for his home suddenly.

   (vi) To grant loan for purchase of a cycle/books or for any other special purpose approved on merits by the Dean and Chairman of the Fund.

3. **Administrative Body:**

The Fund will be administered by a Committee henceforth to be known as Students' Welfare Committee and will comprise:

(i) Dean P.G. School, Chairman

(ii) Registrar (Academic), P.G. School (Secretary and Treasurer)

(iii) Master of Halls of Residences, PGS

(iv) President, P.G.S. Students' Union

(v) Foreign Students' Adviser and

(vi) Ladies Students' Adviser.

4. **Sources**

   (i) Every Student will pay a sum of Rs. 10/- towards this fund at the beginning of each academic year.

   (ii) Contribution from other sources acceptable to the Students' Welfare Committee.

5. Operation of the fund

(a) Sanction of the loan

(i) Students desirous of availing this loan will have to submit their applications to the Chairman of the Students' Welfare Committee through the Secretary of the Committee on a prescribed form.

(ii) "Ordinarily, the amount of the loan to meet the objectives 2 (1 to V) shall not exceed Rs. 300/- for any individual student. However for objective 2 (VI) the maximum amount payable would be Rs. 500/- for cycle etc. and Rs. 700/- for the purchase of books. The amount of the loan will be determined and sanctioned by the Chairman of the Students' Welfare Fund on merit and other existing rules, and subject to availability of the funds".

(iii) Normally, not more than one application for loan will be entertained from the same student during a trimester unless all the previous dues have been paid.

(iv) The student Welfare Committee would ordinarily meet in the beginning of each trimester to consider the formal approval of the expenditure and loan given to the students during the previous trimester.

(v) The sanction of the loan will be intimated to the student concerned who will collect the money from the Treasurer, Students' Welfare Committee, after due acknowledgement.

(b) Deposits and withdrawals

(i) All the contributions to the fund will be deposited in any branch of a nationalised bank as a Savings Bank Account.

(ii) All money transactions will be made by the Treasurer, Students' Welfare Committee. The bank account will be operated jointly by the Chairman and the Secretary.

(c) Refund of the loan

(i) The students will be required to refund the loan granted as per item 2 (I to V) within three months from the date of receipt of the loan. In any case the students must refund the loan within six months from the date of receipt of the same.

(ii) The loan sanctioned and paid against objective 2 (vi) will be repaid in five/seven instalments of Rs. 100/- each commencing from one month after the receipt of the loan or before submission of the thesis or on encashment of bills whichever earlier.

(iii) No interest will be chargeable on the loan granted on or after 18th January, 1980.

Explanatory Note

Chairman of the Fund may, at his discretion, grant the continuing students loans, subject to the maxima and the other restrictions provided in the rules, to cover expenses on payment of mess dues and railway fare for undertaking a journey to home town at the commencement of/during the vacation.

6. General

(i) Abuse of the facilities granted by the Students' Welfare Fund will render the students liable to severe disciplinary action.

(ii) Any item not covered by the above rules will be decided by the Students' Welfare Committee whose decision will be final and binding.

Annexure-XXVII
(Para 17.2)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE

Proforma giving details in respect of Short Term Training Courses

1. Name of the Division:
2. Name of the course:
   (Whether regular or ad-hoc)
3. Brief contents of the course:
4. Duration alongwith proposed dates of the course:
5. Staff member/Faculty member who will be in-charge of the course:
6. Number of trainees to be admitted:
7. Details of qualification and experience prescribed for participants:
8. (a) Number of persons for whom hostel accommodation will be necessary and whether its availability has been ascertained from the concerned Hostel.
   (b) Whether boarding facilities also required:
9. (a) Estimated expenditure on the course:
   (b) Source from which the expenditure will be met:

Annexure-XXVIII
(Para 18.2.2)

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI 110 012

Proforma to be submitted alongwith the application for registration with outside universities for higher degrees.

(To be submitted in duplicate through the Division/Office)

Part-A: (To be filled in by the candidate)

1. Name and designation:
2. Date of appointment:
3. Date since when serving in IARI:
   (including IARI Regional Stations)
4. Establishment on which borne:
5. Parent discipline:
6. Educational qualification:
   (Also mention the subject in which the degree was obtained)
7. Name of the University with which registration to be sought:
8. Title of thesis problem:
9. Whether application for registration with outside university is enclosed in duplicate:
   Yes/No
10. (a) Whether it is proposed to take course work at IARI for this purpose:
    (b) If the answer to (a) is yes, indicate details regarding total credits to be taken and the title of the course:
    (c) Whether it is proposed to take the courses for earning grades or for auditing:
11. Leave requirements:
    (i) Minimum/Maximum time required for completion of course (upto thesis submission): Minimum/Maximum
    (ii) Minimum Residential requirement:
    (iii) Period and Nature of leave required:

Nature of Leave	Period required	
	Months	Days
(a) Study Leave		
(b) Earned Leave		
(c) Half Pay Leave		
(d) Extra Ordinary Leave		
Total:		

Dated: Signature of the candidate

Dated: Consent & Signature of the Head of the Division/Office

Part-B : (To be filled in by the Division)

1. (a) Name of the scheme in which post held:
   (b) Plan or Non Plan
2. Certified that:
   (a) Applicant has completed three years of service at IARI.
   (b) In the event of permission being granted, the work of the Division will not suffer. The grant of study leave/other leave of the duration of the degree programme applied for, i.e.........(Years).........(Months).........is recommended.
   (c) The board of Studies of the discipline/Special Committee of the Division/Unit considered the application in its meeting held on......and has recommended that the application be forwarded.

Dated: Signature of the Head of the Divn.

To

The Chief Administrative Officer
IARI.

Part-C: (To be filled by the Chief Administrative Officer, IARI)

Forwarded to the Dean, P.G. School, IARI for further necessary action.

It is certified that:

(i) the applicant has completed more than three years of regular service under the I.A.R.I.

(ii) in the event of his admission to the course of studies, applied for, at the outside University concerned, he will be granted the study/other leave due and admissible and required by him for completing the course of studies in question.

Dated: Chief Administrative Officer

Annexure-XXIX

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI-110012

Course Evaluation Proforma

Name of the Course and Code No.

Course Instructors:

Academic Year/Trimester:

(To be filled in by the Students)

A. Course Content

1. Is the objective of the course clear ?

Yes No

2. (a) Was the detailed course outline given in the first week of the course ?

Yes No

(b) If the answer to (a) is "No", was it given at all ?

Yes No

3. Were the course contents covered as outlined in the beginning ?

Yes No

4. Was there any overlapping in the course content with any other course ?

Yes No

5. Was the overlapping avoidable without any deficiency in the course content ?

Yes No

6. Do you have any suggestion with regard to the course content ?

Yes No

7. Is the time provided for the course adequate ?

Yes No

B. Teacher

1. Did the instructor(s) take interest in teaching ?

Yes No

2. Did he/they encourage discussion in and outside the class ?

Yes No

3. Was he able to arouse interest in the subject ?

Yes No

4. Was he easily approachable ?

Yes No

5. (a) Did you like the teaching ?

Yes No

(b) If the answer to above is “No” indicate whether it was a part or whole of the course.

Whole Part

(c) If in part, please state which part you did not like.

(d) You did not like the teaching because of (tick mark the most appropriate one):

(i) Poor knowledge of the subject matter

(ii) Poor delivery

(iii) Unpreparedness

C. Teaching

1. Were the theory classes held regularly ?

Yes No

2. Were the text books and other reading materials suggested ?

Yes No

3. (a) Were the library facilities in the Division/Central Library adequate in relation to the course ?

Yes No

(b) If “No’ which text books or journals were wanting ?

4. (a) Were the suggested reading material adequate to cover the course content ?

Yes No

(b) Did you read suggested literature ?

All Part None

5. Were the practical classes held regularly ?

Yes No

6. Were the laboratory facilities for conducting practicals adequate ?

Yes No

7. Was the presentation of subject matter by the instructor clear, definite and forceful?

Yes No

8. Were the practicals conducted by the instructors themselves ?

Yes No

9. Did you have any suggestions for the improvement in the practicals ? if so, please state.

D. Evaluation

1. Should there have been a term paper assigned ?
2. If yes,

    (a) Was the term-paper relevant to the course ?

    Yes No

    (b) Were the term-papers presented in the class ?

    Yes No

    (c) Were the presentations of the term-papers of any benefit to you ?

    Yes No

3. (a) Were the quizzes ?

    Yes No

    (b) Were the quizzes too many ?

    Yes No

4. Did the questions in mid-term and final examinations represent the course content fairly well ?

    Yes No

5. Were the mode of evaluation and weightage for various examinations for the purpose of grading explained in the first week of the course ?

    Yes No

6. Is the evaluation system fair and consistent ?

    Yes No

7. What grade do you expect in this course ?

    A B C D E

E. Others

1. Why did you take this course ?
2. Is your expectation from the course fulfilled ?

   Yes No

3. How would you evaluate the course ?

   Excellent V. Good Good Fair Poor

Annexure-XXX

PROFORMA FOR SENDING RESULT OF MAKE UP EXAMINATION IN RESPECT OF MISSING FINAL THEORY EXAMINATION

Course No. Credit:

Title of the Course:

Total No. of Classes conducted: Lectures: Practicals:

Roll No.	Name of student	No. of classes attended		Grade Awarded
		Lect.	Pract.	
1.				
2.				
3.				

Certified that the student has completed 75% attendance separately in lectures and practicals.

Signature
& Name of Course Leader

Signature of Professor

To

Dean, P.G. School.

Annexure-XXXI

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI-110012

Proforma for Membership of the Post-Graduate Faculty

1. Name:
(In block letters)

2. Date of birth:

3. Parent discipline:

4. Present place of posting:

5. i) Designation:
   ii) Field of specialisation:
   iii) Specific area of research work:

6. Educational qualifications:

Name of the Degree	Name of the University	Whether by course work alone or course work + thesis	Year	Class/Division/ Equivalent Grade
a. *B.Sc./B.Tech./B.A.				
b. *M.Sc./M.Tech./M.A.				
c. Ph.D.				

*Strike out words not applicable

7. Professional record:

Designation and grade	Period from	Period to	Institution and place of posting
a.			
b.			
c.			

8. Teaching discipline in which faculty membership is sought:

9. Publications:

	Title of the paper	Whether with senior or sole authorship	Scientific Journal in which published (indicate volume No. and month of publication)
a.			
b.			
c.			
d.			
e.			

Attach statement, if necessary
(Atleast 3 papers should be with Senior or sole authorship)

10. Total years of research/extension experience:

11. Total years of teaching experience at P.G. Level, if any:

12. Courses taught:

Signature of applicant

1. Date of Seminar given by applicant

2. Recommendation by the Board of Studies for faculty membership in the discipline of............(full justification with specific recommendation whether applicant's induction to the faculty will add to the efficiency of the teaching programme in the discipline may be given).

Chairman of the Board of Studies

(For Post-Graduate School)

Recommended by the Standing Committee on Faculty, Student's Problems and Discipline for faculty membership on......................

Chairman, Standing Committee on Faculty,
Student's Problems and Discipline

Annexure-XXXII

POST-GRADUATE SCHOOL
INDIAN AGRICULTURAL RESEARCH INSTITUTE
NEW DELHI-110012

Proforma for becoming eligible for Research Guide

1. Name:
   (In block letters)
2. Date of birth:
3. Parent discipline:
4. Present place of posting:
5. i) Designation:
   ii) Field of specialisation:
   iii) Specific area of research work:
6. Educational qualifications:

Name of the Degree	Name of the University	Whether by course work alone or course work + thesis	Year	Class/Division/ Equivalent Grade
a. *B.Sc./B.Tech./B.A.				
b. *M.Sc./M.Tech./M.A.				
c. Ph.D.				

*Strike out words not applicable

7. Professional record:

	Designation and grade	Period from	Period to	Institution and place of posting
a.				
b.				
c.				

8. Teaching discipline in which faculty membership has been granted (No. and date of PG School letter may please be quoted).

9. Publications (published after induction into faculty):

Title of the paper	Whether with senior or sole authorship	Scientific Journal in which published (indicate volume No. and month of publication)
a.		
b.		
c.		
d.		
e.		

Note: (1) 3 papers essential for those who want to guide M.Sc. students and 5 for those who want to guide Ph.D. students.

(2) Atleast 2 papers should be with senior or sole authorship.

10. Total years of research/extension experience:

11. Total years of teaching experience at PG School (one trimester teaching in each year will be taken as 1 year experience)

12. Courses taught:

13. Details regarding membership in the Advisory Committees of the students:

Date: Signature of applicant

1. Recommended by the Board of Studies for

Research Guide in the discipline of ____________.

Chairman of the Board of Studies

(For Post-Graduate School)

Recommended by the Standing Committee on Faculty, Student's Problems and Discipline for enrolment as Research Guide on________________.

Chairman, Standing Committee on Faculty,
Student's Problems and Discipline

Annexure-XXXIII

GUIDELINES FOR UTILISATION OF THE CONTINGENT GRANT PAYABLE IN RESPECT OF THE SENIOR RESEARCH FELLOWS (Ph.D. STUDENTS) AND JUNIOR RESEARCH FELLOWS (M.Sc. STUDENTS) OF THE INDIAN AGRICULTURAL RESEARCH INSTITUTE

1. (a) The contingents grant of Rs. 5,000/- per academic year will be paid to the senior fellows towards the cost of experimental material, books required for the study as prescribed by the Chairman/Professor of the student and for preparation of thesis and study tour. The students holding junior fellowship will be eligible for the payment of contingent grant of Rs. 2,000/- per academic year for meeting the expenditure on study tours, experimental material, purchases of books and preparation of thesis.

1. (b) In the beginning of each academic year, P.G. School will send and expenditure statement showing the amounts spend under the contingent grant and the balance amount available in respect of each student of Professor of the discipline concerned so that he can ensure that the amount is spend equitably and sufficient funds are available for preparation of the thesis.

1. (c) While utilising the contingent grant due care should be taken to keep adequate provision for the purchase of recommended books, thesis preparation and purchase of special chemicals etc. In this context the following guidelines may be observed:

Ph.D.	Purpose
Ist year	Purchase of books and special chemicals.
2nd year	Purchase of books and special chemicals.
3rd year	Purchase of books, special chemicals and thesis preparation.
M.Sc.	
1st year	Purchase of books and special chemicals.
2nd year	Purchase of books, special chemicals and thesis preparation.

Note: The students' contingent grant can be utilised for general requirement of students in the Division in consultation with the Professor and Chairman of the concerned student keeping in view the availability of funds and the individual student's own requirements for books, tour, thesis preparation and other contingent expenditure on special chemicals etc.

2. (a) Whenever students proceed on approved study tour and are required to say overnight at the place of their visit they will be eligible for DA @ Rs. 20/- per day. The expenditure on TA/DA will be limited to the following ceilings:

(i) Ph.D. Students	—	Rs. 500/- per year
(ii) M.Sc. students	—	Rs. 250/- per year

In case where field study and research work involves longer stay and the expenditure is likely to exceed ceilings prescribed above, special sanction of the Dean should be obtained.

2. (b) Re-imbursement of expenditure towards purchase of books, publications and for preparation of their thesis from out of the contingent grant will be made only on production of vouchers/cash memos etc. *in duplicate* to the Dean's office after incorporating the following certificates in each copy of the vouchers/cash memo etc. by the *Guide* and Professor of the student:

(i) Certified that the amount as shown in the cash memo/paid receipt has actually bean spent by me towards purchase of books/reparation of thesis/Research work/ Publication/Registration etc. Also certified that all material for which cash Memo/ Paid receipt is presented is in my possession.

(Signature of student with date)

OR

Certified that the material as shown in the Bill/pre-receipted bill has been received by me and is in my possession and will be utilised for preparation of thesis/ Research work/publication/purchase of books etc. connected with my studies at IARI. Amount shown in the bill may therefore be paid to the firm concerned directly.

(Signature of student with date)

(ii) Certified that the amount as claimed and utilised for the purpose as shown in the voucher is an essential requirement for his/her research work and the student has purchased only the recommended items in fulfilment of his/her research work.

(Signature of the guide with date)

(Signature of the Professor with date)

2. (c) Book not relatable to the research or course work of the students will not be purchased from contingent grant. The students should prepare the lists of books proposed to be purchased by them and get them approved from the Professor before the books are purchased. The Professor should ensure that a uniform policy is followed in the matter of purchase of books by the students and no deviations are permitted in the selection of books.

2. (d) Divisions desirous of purchasing chemicals, equipment, glass apparatus etc., from out of contingent grant should procure the same in accordance with the normal procedure followed in the divisions for all divisional purchases of stores item and the pre-receipted bills sent to the Dean's Office after recording the prescribed certificates on the body of the bills as in the case of normal divisional purchases. The expenditure involved in such cases should be debited against respective student's contingent grant and the particulars of the student for whom the item has been purchased by the Division should be indicated on the body of the bill to enable the Dean's office to book the expenditure accordingly in the student's individual ledger.

2. (e) A maximum of Rs. 5000/- and Rs. 3000/- will be available for preparation of thesis for senior and junior research fellows respectively during the tenure of the fellowship.

3.(a) In no case of the total contingent expenditure per fellow would be allowed to be more than the provision indicated in para 1 above.

3. (b) The contigent amount left unspent at the end of the year of fellowship tenure could be spent in the subsequent year in addition to the provision for that year (subsequent year). The year for this purpose is to be reckoned from the date and/or month of award of the sanction.

4. Fellows are required to purchase books from bona-fide booksellers only, who are members of the Delhi State Book-Sellers' Association, the list of which is available in the I.A.R.I. Library.

5. Fellows are required to produce books alongwith the cash memo to the P.G. School Office for physical verification of books and embossing the prescribed stamp on the books.

6. The Contingent grant is not intended for meeting the expenditure on furniture etc. payment of labour charges for field experiments. Items like towels, buckets, locks, pen etc. are not covered as research items and connot be purchased out of contingent grant.

7. No fees and other charges of the Institute which are required to be paid by the fellows would be met from the contingent grant. However, the fellowship holders will get reimbursement of registration fee for attending/participation in Symposium organised by Scientific Societies/International Congresses/Seminars etc. upto ceiling of Rs. 300/- and Rs. 500/- in respect of M.Sc. and Ph.D. students respectively in an academic year. However, in any case the registration fee reimbursable during the entire period of tenure of fellowship would not exceed Rs. 500/- and Rs. 1000/- in respect of M.Sc. and Ph.D. students respectively. This reimbursement will be admissible only if the full justification for attending the seminar/ conference etc. have been furnished and approval of the Dean obtained in advance.

8. The expenditure on study tours will be met out of the TA head of contingent grant as shown in rule-2 (a) above. For journeys undertaken in this regard during the currency of the fellowship, the fellows will be paid travelling allowance at the following rates:

(i) *For journey by rails:* One Second class single rail fare both ways by shortest and convenient route.

Reservation, sleeper and super express charges are admissible over and above the 2nd class rail fare fore both study tours and for joining the Institution and return journey to home on completion of course.

(ii) *Journey by road:* Before or in continuation of rail journey or for journey by road between places *not connected by train*, T.A. will be paid at actual cost of road travel by public bus or six paise per kilometer for Journey on bicycle/foot or 50 paise per K.M. for journey by Rikshaw/Motor cycle/Scooter. Whenever the road journey is performed between places *connected by rail*, T.A. for the road journey will be paid at actual cost of bus fare limited to 2nd class rail fare.

(iii) *Journey by road in hill areas:* Whenever a road travel is undertaken for study tours in connection with their approved course of study in hill areas only, where railway facilities do not exist, fellows will be paid T.A. for hill journey only at the rates equal to one actual single fare by public bus or Rs. 0.50 paise per kilometer or journey by motor cycle/scooter.

(iv) Return journey ticket wherever admissible should be availed of on all study tours.

(v) Fellows are required to indicate ticket number of their railway journey, while submitting their T.A. bills and are also required to produce tickets, in support of their actual bus journey wherever claimed for in hill areas and in plains.

(vi) No travelling allowance will be admissible for journey undertaken within 8 Kilometers radius of this Institute.

(vii) The fellows will be entitled for *daily allowance* @ Rs. 20/- per day limited to 50 days in a year.

9. Any tools, equipment, laboratory supplies, animals and any other item of non-consumable nature purchased out of the contingent grant for use of the fellows will become the property of the Division after the completion of his study. As the pocket calculator is an essential requirement and will be useful to the fellows for training and research in future, there should be no objection to permitting the students to purchase pocket calculator at a cost not exceeding Rs. 500/- which they can retain with them. The student can purchase Atlas or Dictionary not exceeding at a total cost of Rs. 500/- for both.

10. Student can purchases calculator's books, Atlas, Dictionary etc. prior to the date of their proposal for submission of thesis OR Three months before submission of thesis which ever is earlier. Thereafter no such claim will be entertained for reimbursment by the P.G. School Office.

11. On termination of fellowship, books and publications purchased out of the contingent grant will become the property of the fellow concerned.

12. The academic year for the purpose of availing of contingent grant will be reckoned from the beginning of October of the year of admission to the end of September of the following year irrespective of the date of issue of sanction of the award.

A. UNDERTAKING

I hereby undertake that if I am selected for the post/fellowship applied for by me, I shall not leave the work assigned to me under the Indian Agricultural Research Institute fellowship programme unfinished.

In witness whereof I ....
have signed those present on the .... day of ....

Signature ....

(Ph.D./M.Sc.) ....

Roll No. ....

Address ....

....

In the presence of

I. 1. Signature ....
2. Name in full ....
3. Designation ....
Address ....

II. 1. Signature ....
2. Name in full ....
3. Designation ....
Address ....

B. UNDERTAKING

As I have been offered a Junior/Senior Fellowship of the Indian Agricultural Research Institute for study and research leading to M.Sc. (Agriculture)/Ph.D. in the subject of .... and as I have accepted the said Fellowship and also the terms and conditions governing the Fellowship, I hereby undertake that I shall complete the study and research work assigned to me by the Guide. I also undertake that I shall not leave the course before its completion without prior approval of the Dean, P.G. School. I also certify that I am not drawing any other fellowship/scholarship from any source. I shall not accept any other fellowship without the permission of the Dean.

In witness whereof I .... have signed those present on the .... day of ....

Signature ....
Roll No. ....
(Ph.D./M.Sc.) ....
Address ....
....

In the presence of:

1. Signature ....
Name in Full ....
Designation ....
Address ....
....

2. Signature ....

Name in Full ....

Designation ....

Address ....

....

C. APPLICATION FOR EXTENSION IN THE TENURE OF THE I.A.R.I FELLOWSHIP

Name of the Fellow: Roll No.

Division:

2. Whether awarded Junior or Senior fellowship.
3. Date of start of the fellowship.
4. Period for which fellowship sanctioned.
5. Period for extension of the fellowship sanctioned earlier, if any.
6. Date of registration with the Institute for M.Sc./Ph.D.
7. Minimum period after registration prescribed by the Institute for submission of thesis.
8. Grade point Average up-to-date (where applicable)
9. Date of passing the comprehensive examination (where applicable).
10. Report of the work done so far by the fellow with reference to the time schedule submitted earlier.
11. The work that remains to be done.
12. Specific justification for not completing the work according to the time schedule.
13. Detailed justification in support of the proposal for extension of the tenure of fellowship.
14. Period of extension necessary.

Signature of the Fellow.

15. Recommendations of the Guide of the fellow.

Signature of the Guide of the Fellow:

Designation

Place:

16. Recommendations of the Professor:

Note: (Attach separate sheets if space be insufficient under any item.)

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भारतीय कृषि अनुसंधान संस्थान औषधालय
Indian Agricultural Research Institute Dispensary
नई दिल्ली-110012
NEW DELHI-110012
बहिरंग रोगी टिकट
OUT-DOOR PATIENT TICKET

क्रम संख्या/No.......... दिनांक/Date 11/8/97

रोगी का नाम
Name of Patient Shyamal 3697

आयु लिंग रोग
Age.......Sex.........Disease (Strepti)

पुर्नरागमन Return Visits	उपचार Treatment
Rx	A. Pharyngitis Tab ~~Actifed~~ Tricavil 1 HS —0 Cap Declox 1 TDS × 2dy Saline gargling × 2dy Tab Vit C 500mg 1 OD —0 × 2dy 1—0—0 Syp Trian 2 tsf TDS × 2d 11/8/97

Medical Officer Incharge
I.A.R.I. Dispensary
New Delhi-110012.